THE DUPONT AEROSPACE DP–2 AIRCRAFT

HEARING

BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT

COMMITTEE ON SCIENCE AND TECHNOLOGY

HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

FIRST SESSION

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June 12, 2007

THE DUPONT AEROSPACE DP–2 AIRCRAFT

TUESDAY, JUNE 12, 2007

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Subcommittee met, pursuant to call, at 9:40 a.m., in Room 2318 of the Rayburn House Office Building, Hon. Brad Miller [Chairman of the Subcommittee] presiding.

BART GORDON, TENNESSEE
CHAIRMAN

RALPH M. HALL, TEXAS
RANKING MEMBER

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Investigations and Oversight Subcommittee

Hearing on

The duPont Aerospace DP-2 Aircraft

2318 Rayburn House Office Building
Washington, DC

Tuesday, June 12, 2007
9:30 p.m. – 12:00 noon

Witnesses:

Panel I

The Honorable Duncan Hunter (CA-52)
Ranking Member, House Armed Services Committee

Panel II

Mr. John Eney
Former Head, Aircraft Conceptual Design Group, Naval Air Development Center (NADC) and Naval Air Systems Command (NAVAIR)

Dr. William Scheuren
Former DARPA DP-2 Program Manager and former Harrier Test Pilot

Mr. Mark Deadrick
Former duPont Aerospace employee

Panel III

Mr. Anthony "Tony" duPont
President, duPont Aerospace Company

Panel IV

Mr. John Kinzer
DP-2 Program Manager, Office of Naval Research

Col. G. Warren Hall (ret.)
NASA AMES Chief Test Pilot and Chairman of the DP-2 Air Worthiness Review Panel

Lt. Col. Michael Tremper
Defense Contract Management Agency resident pilot at duPont Aerospace Company

HEARING CHARTER

SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT
COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

The duPont Aerospace DP–2 Aircraft

TUESDAY, JUNE 12, 2007
9:30 A.M.–12:00 P.M.
2318 RAYBURN HOUSE OFFICE BUILDING

Overview/Purpose

The Subcommittee on Investigations & Oversight will meet on Tuesday, June 12, 2007, to examine the history, technical viability, critical assessments, testing mishaps and management of the DP–2 Vertical/Short Takeoff and Landing (V/STOL) aircraft being developed by the duPont Aerospace Company. The DP–2 program, funded exclusively through congressional earmarks since 1988, has received more than $63 million. Yet, multiple technical reviews of the DP–2 concept have repeatedly rejected it on its technical merits since 1986, and serious concerns continue to arise about the ability of duPont Aerospace to effectively and safely manage the program. Three DP–2 prototype aircraft have been developed, and the DP–2 has suffered from four mishaps in the past four years. The Subcommittee on Space and Aeronautics held a hearing on this project in May 2001.

The purpose of this hearing is to review the technical virtues of the DP–2, concerns about the safety of the aircraft, duPont Aerospace's management of the program and the company's adherence to safety protocols and procedures. This is particularly important given the fact that Tony duPont, President of the duPont Aerospace Company, envisions the development of a commercial version of the DP–2 aircraft. Finally, the Subcommittee will examine what sort of return on investment the U.S. Government has received for its two decades of support and more than $63 million investment in this program to date.

During his testimony to the House Committee on Science in May 2001, duPont said the commercial airline industry including Boeing, Lockheed and Grumman did not invest in his concept of the DP–2 aircraft because they were skeptical of his ability to actually achieve success. Six years later, it appears the DP–2 program has accomplished very little. Yet, duPont continues to receive a steady stream of congressional funding. The key question is why Congress should continue to invest in this program today?

Background

Tony duPont conceived of his V/STOL aircraft as a business jet in the early 1970s and called it the DP–1. In 1972, he first proposed his larger airplane, called the DP–2, to the Defense Department. Both aircraft designs relied on the concept of vectored thrust—which would permit the aircraft to direct the thrust from its engines both downward projecting the aircraft upward and permitting it to hover, as well as backward propelling the aircraft forward while in flight. As envisioned by duPont, the DP–2—once operational—would be capable of ferrying up to 48 fully equipped troops into combat zones, landing on remote oil drilling platforms or rooftops in crowded urban areas. Commercial versions of the aircraft would transport between 50 and 200 passengers to inaccessible resort destinations or directly to the greens of prestigious golf courses.

The U.S. Navy received an unsolicited proposal from Tony duPont for the DP–2 in 1986. But the Navy found a litany of technical problems with the aircraft and recommended that the "DuPont DP–2 concept be dropped." In 1990, the Defense Advanced Research Projects Agency (DARPA) conducted a second technical assessment of the DP–2 and concluded: "It is DARPA's assessment that the design cannot be adapted from its commercial aircraft application to the military requirement. . . . Additionally, concern over the practicality of the basic DP–2 aircraft was expressed by the technical experts consulted by DARPA," the report declared. In 1999, the Naval Air Systems Command (NAVAIR) conducted a technical oversight trip to the duPont Aerospace facility in San Diego. The oversight team, which included one dozen aerospace experts, discovered a disturbing series of problems in how the DP–2 aircraft was being manufactured. The team's reports detailed problems in the fabrication and assembly of the aircraft, quality control processes and procedures, materials development and safety procedures, among other things. The oversight team found, for instance, that no ejection seats had been planned or installed for the DP–2, even though it was being developed as a military aircraft. The review concluded that "The integrity of the [aircraft] to conduct safe hover or forward flight operations is questionable." In the end, the team said the aircraft's technical faults would "produce an extremely unsafe vehicle, not worthy of flight."

Despite those reviews and subsequent problems on the program, earmarks for the DP–2 have not ceased. Congress first earmarked funds for duPont Aerospace to begin development of the DP–2 program in 1988 through DARPA. But technical concerns about the aircraft's viability and safety performance were so great that DARPA refused to expend $30 million on the project that Congress had appropriated for it. The agency went so far as to have its General Counsel author three separate legal opinions in the early and mid-1990s stipulating why DARPA should not fund the project. The earmarked funds first began to flow to duPont Aerospace in 1993, according to the Defense Department. In 1997, the Office of Naval Research (ONR) took over management of the program, where it remains today. In FY 2002 and FY 2003, $7.5 million in grants were earmarked for the DP–2 program through NASA as well. In April 2003, a NASA analysis of the DP–2 concept found "that the DP–2 effort is not worthy of continued funding." Still, since then NASA has played a critical technical oversight role, working with ONR and acting as Chair of the ONR DP–2 Airworthiness Review Panel.

Over the past four years, two separate DP–2 prototypes have suffered from four mishaps, and some government officials have questioned the competence and capabilities of duPont Aerospace. In November 2003, during a controlled hover test at Gillespie Field in San Diego, the public airport where the company maintains the DP–2, the aircraft had a "hard landing" and suffered significant damage. The aircraft has only been allowed to attempt to hover while it is tied down via tethers to a metal helicopter stand. During this test, Tony duPont removed the nose tether of the aircraft, which was a violation of the approved testing procedures. The crash resulted in $88,000 in material damage and required an estimated 1,150 man-hours to repair, according to duPont's own estimate.

The aircraft suffered a second failure in November 2004 when its "nozzle box" composite structure failed due to engineering deficiencies, according to a NASA review. Most disturbing was the fact that the DP–2 test pilot was in the cockpit at the time, which again violated safety protocols that had been established for the test. Fortunately, the pilot, whose helmet struck the ceiling of the cockpit as the cabin floor cracked and the aircraft filed with hot exhaust and composite dust, was unharmed. He escaped through the right cabin window because the main cabin door had been jammed shut. The aircraft suffered a second nozzle box failure in April 2006 that was attributed to structural design issues. Last August, it suffered from its fourth accident in four years when a computer glitch on the navigation computer software of the aircraft caused the aircraft to hover too high and then slammed back down on the test stand, damaging the wing. The DP–2 aircraft is expected to begin a new round of hover tests later this month.

In addition to the serious safety issues that have been called into question regarding the management of the DP–2 program, the Subcommittee has learned that questions regarding duPont's financial management of the program have also emerged. According to a 2004 Department of Defense audit of the company, duPont Aerospace attempted to misallocate at least some of the Congressional funding it has received. The audit found that duPont billed the government nearly $7,000 in unallowable costs, including $1,700 for polo-shirts with duPont's logo imprinted on them, nearly $2,000 for an annual company picnic and more than $3,000 for a family vacation on a cruise ship. The questioned costs were below the $10,000 "threshold" limit set by Federal Acquisition Regulations so duPont received a penalty waiver and removed the costs from the claimed costs they submitted to the U.S. Government.

Witnesses

The Subcommittee hearing will be composed of four panels that will explore the past, present and current state of the DP–2 aircraft concept. The Honorable Duncan Hunter (CA–52) will be the sole witness on **Panel I.** Mr. Hunter is currently the Ranking Member and formerly the Chairman of the House Armed Services Committee and has been a long-time supporter of the DP–2. **Panel II** will include individuals involved in critical reviews of the DP–2 in 1986, 1990 and 1999. It also includes the former duPont Aerospace Manufacturing Engineering Manager who worked at the firm in the early 1990s and again from 2002 to 2005. Tony duPont will be the exclusive witness for **Panel III** and will testify via video-conference from San Diego. He will be asked to respond to criticism of both the technical merits of the DP–2 concept, safety concerns with the aircraft and his management of the program. **Panel IV** will include the key individuals currently involved with the government's management and oversight of the DP–2 program. They will address recent safety issues with the program, including the cause of four accidents with the aircraft in the past four years, technical hurdles with the performance of the DP–2 and overall management of the program by duPont Aerospace.

Panel I:

The Honorable Duncan Hunter (CA–52) is currently the Ranking Member and formerly the Chairman of the Armed Services Committee. Mr. Hunter has been a long-time supporter of the DP–2.

Panel II:

Mr. John Eney, former Head, Aircraft Conceptual Design Group, Naval Air Development Center (NADC) and Naval Air Systems Command (NAVAIR). Mr. Eney first reviewed the DP–2 concept in 1986 and later led a team of senior Navy aerospace engineers on a site visit to the duPont Aerospace facilities in San Diego in 1999 while the first DP–2 prototype was partially completed.

Dr. William Scheuren was on a DARPA review team that provided a critical evaluation of the technical merits of the DP–2 concept in 1990. He later became the DARPA DP–2 Program Manager in the mid-1990s and is former Commanding Officer of the first Marine Corps Harrier Squadron. Dr. Scheuren holds a Ph.D. in Applied Research and has been a test pilot on fighter aircraft, multi-engine transports, helicopters, seaplanes and V/STOL aircraft, including the X–22, a predecessor to the V–22 Osprey tilt-rotor aircraft.

Mr. Mark Deadrick, former Manufacturing Engineering Manager, duPont Aerospace Company. Mr. Deadrick first began working for duPont Aerospace as a college intern in 1988. He was employed as a full-time Mechanical/Aerospace Engineer at duPont from 1992 to 1994 and as Manufacturing Engineering Manager from 2002 to 2005, when he was in charge of the composite fabrication and assembly of the DP–2 aircraft.

Panel III:

Mr. Anthony duPont, President, duPont Aerospace Company. Mr. duPont's proposed aerospace plane and engine design concept was selected as the government's baseline design for the National Aerospace Plane (NASP) program in 1983. He holds eight patents and is a former co-pilot for Pan American World Airways. Mr. duPont founded the duPont Aerospace Company in 1969 to pursue the development of VSTOL aircraft using vectored thrust. He first proposed the DP–2 aircraft design concept in 1972.

Panel IV:

Mr. John F. Kinzer, Deputy Director of the Air Warfare and Naval Weapons Division at the Office of Naval Research and the DP–2 Program Manager. He is a former graduate of the U.S. Navy Fighter Weapons School (Topgun) and retired as a Navy Captain in 1999. He has flow over 35 different types of aircraft and has been involved in oversight of the DP–2 program for the past eight years.

Mr. G. Warren Hall, Chairman of ONR's DP–2 Airworthiness Review Panel and Assistant Director for Aviation and Chief Test Pilot at NASA Ames Research Center. Mr. Hall completed twenty-eight years of Military Service retiring as the Commander of a California Air National Guard Rescue Group, with the rank of Colonel. He has authored seventy-three technical reports and has flown over 65 different aircraft.

Lt. Col. Michael Tremper (USAFR), Defense Contract Management Agency, Government Flight Representative to duPont Aerospace Company. Lt. Col. Tremper is a pilot for Delta Airlines and has been the Government Flight Representative to duPont Aerospace since 1999 providing operational oversight of the DP–2 program.

Ms. Marie Greening, Director, Aeronautical Systems Division, Defense Contract Management Agency, will accompany Lt. Col. Tremper to the hearing.

Chairman MILLER. This hearing will come to order. I understand that Mr. Hall is on his way, and when he arrives, we will certainly break to allow his opening statement. He is not here in the ordinary course, but we want to respect Mr. Hunter's time and those of everyone else and go ahead and begin.

Our hearing today is about the amazing staying power of the duPont Aerospace DP–2, or rather, the remarkable staying power of the project's taxpayer funding. The DP–2's concept is a vertical takeoff aircraft, but flight remains an aspiration for the DP–2, not an achievement. The DP–2 is still not operational, and has never received a positive technical review in more than 20 years.

To put that in perspective, the Wright Brothers first achieved powered flight in North Carolina in December 1903. I understand that the State of Ohio also had some loose association with that project. A little more than a decade later, the airplane was an effective weapon in World War I. Charles Lindbergh flew the Atlantic in May 1927, less than 24 years later.

The government agencies—welcome Mr. Hall—through which Congress has provided the funding for the DP–2 have never requested the experimental aircraft. The Defense Advanced Research Projects Agency, DARPA, refused to spend the funds that Congress appropriated for the project for seven years, because the Agency's technical judgment that the concept was fundamentally impractical. Just three years ago, NASA, which was then funding the project, also concluded that the DP–2 was "not worthy of continued funding."

The concept for the DP–2 Vertical/Short Takeoff and Landing Aircraft was first proposed by Tony duPont, President of duPont Aerospace Company, 35 years ago. He envisioned using vectored thrust in a business-class jet. Vectored thrust permits an aircraft to direct the thrust from its engines both downward, projecting the airplane upward and allowing it to hover, as well as backward, which would propel the aircraft forward while in flight. Mr. duPont was unable to attract private sector funding for the idea, so he turned to the military.

In 1986, responding to an unsolicited proposal from Mr. duPont, the Navy concluded that, again quoting, "the duPont DP–2 concept should be dropped." In 1988, the DP–2 received its first $3 million earmark, which was inserted into DARPA's budget. In 1990, DARPA questioned, again, the "practicality of the basic DP–2 aircraft." In the succeeding years, every single review has found overwhelming technical problems with DP–2, and some have questioned whether the aircraft will ever fly at all. These reviews and others have found the DP–2 aircraft unsafe, technically unsound, and unwanted by the U.S. government, by the Defense Department, or commercial airline industry.

In addition, Government officials have repeatedly questioned the ability of the contractor, the duPont Aerospace Company, to manage the program effectively and safely. Government officials have temporarily shut down the DP–2 program twice in the past five years because of safety concerns, and the program has suffered from four major mishaps in the last four years. In one of those mishaps, the pilot was lucky to have escaped without injury. The aircraft was at that time not hovering but was earthbound.

It is hard not to admire Tony duPont's persistence and unshakeable faith in the promise of the DP–2 project. But after two decades of research, development, and testing, the United States Government has little to show for its investment. Congress appears to have permitted the DP–2 program to become a hobby, not a serious research project, and squandered more than $63 million of taxpayers' money.

As one of our witnesses will testify today, the DP–2 is not suitable for either military or commercial applications. The plane needs a complete redesign and substantial improvements in the engineering expertise provided by duPont Aerospace to have even a chance of getting to a full test. But the DP–2 is only one of several competing concepts for vertical take-off aircraft. If we need to start all over, why not spend our money on the concepts that the experts, on whose judgments we should rely, believe are far more likely to succeed?

I now recognize the Full Committee Ranking Member, Mr. Hall, for his opening statement.

[The prepared statement of Chairman Miller follows:]

PREPARED STATEMENT OF CHAIRMAN BRAD MILLER

Our hearing today is about the amazing staying power of the duPont Aerospace DP–2, or rather the remarkable staying power of the project's taxpayer funding. The DP–2's concept is a vertical take-off aircraft, but flight remains an aspiration for the DP–2, not an achievement. The DP–2 is still not operational, and has never received a positive technical review in more than 20 years. To put that in perspective, the Wright Brothers first achieved powered flight in North Carolina in December, 1903. (The State of Ohio also had some loose association with that project.) A little more than a decade later, the airplane was an effective weapon in World War I. Charles Lindbergh flew the Atlantic in May, 1927, less than 24 years later.

The government agencies through which Congress has provided the funding have never requested the experimental aircraft. The Defense Advanced Research Projects Agency (DARPA) refused to spend funds that Congress appropriated for the project for seven years based upon the agency's technical judgment that the concept was fundamentally impractical. Just three years ago, the National Aeronautics and Space Administration (NASA), which was funding the program at the time, also concluded that the DP–2 was "not worthy of continued funding."

The concept for the DP–2 Vertical/Short Takeoff and Landing (V/STOL) aircraft was first proposed by Tony duPont, President of the duPont Aerospace Company, thirty-five years ago. He envisioned using vectored thrust in a business-class jet. Vectored thrust permits an aircraft to direct the thrust from its engines both downward—projecting the plane upward and allowing it to hover, as well as backward which would propel the aircraft forward while in flight. He was unable to attract private sector funding for the idea, so he turned to the military.

In 1986, responding to an unsolicited proposal from Mr. duPont, the Navy concluded that the "duPont DP–2 concept [should] be dropped." In 1988, the DP–2 received its first $3 million earmark, which was inserted into DARPA's budget. In 1990, DARPA questioned the "practicality of the basic DP–2 aircraft." In the succeeding years, every single review has found overwhelming technical problems with the DP–2, and some have questioned whether the aircraft would ever fly. These reviews and others have found the DP–2 aircraft unsafe, technically unsound and unwanted by the U.S. Government, Defense Department or commercial airline industry.

In addition, Government officials have repeatedly questioned the ability of the contractor—the duPont Aerospace Company—to manage the program effectively and safely. Government officials have temporarily shut the DP–2 program down twice in the past five years because of safety concerns, and the program has suffered from four mishaps in the past four years. In one of those mishaps the pilot was lucky to have escaped without serious injury.

It is hard not to admire Tony duPont's persistence and unshakeable faith in the promise of the DP–2 project. But after two decades of research, development and testing on the DP–2, the U.S. Government has very little to show for its investment.

Congress appears to have permitted the DP–2 program to become a hobby, not a serious research project, and squandered more than $63 million of taxpayers' money. As one of our witnesses will testify today, the DP–2 is not suitable for either military or commercial applications. The plane needs a complete redesign and substantial improvements in the engineering expertise provided by duPont Aerospace to even have a chance of getting to a full test. But the DP–2 is only one of several competing concepts for vertical take-off aircraft. If we need to start all over, why not spend our money on the concepts that the experts on whose judgment we should rely believe are far more likely to succeed?

Mr. HALL. Mr. Chairman, I thank you. I don't agree with you, but I thank you.

Here we are today to discuss a research project that is funded through the Department of Defense, called DP–2, as you have set out. However, your lack of belief in this type of experimentation, with no personal intent here to offend you is: I had an old lady 84 years old, and that is exactly how old I am today, and I thought she was ancient then. When the first space shot was made, she said it will never go up, and when it did go up, her answer was it will never come down.

So, have some faith in the experimentation. Sometimes, this will push the Osprey people, and I just think that the goal of this high-risk, high-reward research is to develop advanced vertical and takeoff landing technology that is going to be beneficial to our armed forces, and vector to lift capabilities are important to our soldiers, and any increase in system performance ultimately saves lives, and on the gentleman who sits in front of us here to testify, if there is a more respected guy in the entire Congress than Duncan Hunter, a more red, white, and blue guy, I just don't know who it is. The faster you can get in and out of an area, the less time you spend on-site, the more capabilities you can bring to bear, the safer our troops are going to be. I think we can all agree that developing technology that makes our troops safer is a very, very important goal, and I am sure you share that desire.

To put this project in context, the DP–2 program represents a fraction of the vertical takeoff and landing budget spent by the Department of Defense. The V–22 Osprey has been allocated $11.3 billion to date, not including the science and technology funds. The DP–2 program, in contrast, has received $63 million, not billion, or 0.5 percent of the V–22 budget, and sometimes, these projects are joint projects, and they push one another, and like in the medical field, you know, all these medical people race for a cure, and they can spend millions of dollars racing for that cure, but the one that comes in second doesn't get anything. The one that gets there first winds up with all of it. And sometimes that is the way it is in projects like we are talking about here today.

The project has received bipartisan support. The Armed Services Committee and the Appropriations Committee have provided funds since 1988, during both Democratic and Republican controlled Congresses. The DP–2 project has faced many technical challenges, as should be expected for revolutionary technology. I look forward to hearing about some of these challenges today, as well as the potential benefits of the project to our troops on the ground.

And as this committee is aware, the DP–2 project exists because Members of Congress requested this program. Every year, the Armed Services Committee receives Member requests dealing with the Department of Defense. Some of these requests, such as the DP–2 program, offer revolutionary, innovative technologies that will save lives if they are successful. Certainly, requests for advanced body armor have proved essential to our fighting forces. Other requests are not related to saving lives, such as the $1.3 million continuing appropriation from the defense budget to Palomar Medical Technologies for the study of razor burn.

We are devoting three panels today to this one Member requested project. I just ask is this committee also planning on spending time debating the merits of some of the lesser technologies? And I ask this committee if we shouldn't be spending hours of our day discussing the Department of Defense's study of technology that will get our troops out of harm's way quickly, of the Department of Defense's study of other, lesser, minor thrusts.

Mr. Chairman, I respect you, and I yield back my time.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

Thank you, Mr. Chairman. We are here today to discuss a research project funded through the Department of Defense called DP–2. The goal of this high-risk, high-reward research is to develop advanced vertical takeoff and landing technology that will greatly benefit our armed forces. Vectored lift capabilities are important to our soldiers, and any increase in system performance ultimately saves lives. The faster you can get in and out of an area; the less time you spend on-site; and the more capabilities you can bring to bear, the safer our troops will be. I think that we can all agree that developing technology that makes our troops safer is an important goal.

To put this project in context, the DP–2 program represents a fraction of the Vertical Take Off and Landing budget spent by the Department of Defense—the V–22 Osprey has been allocated $11.3 billion to date, not including the science and technology funds. The DP–2 program, in contrast, has received $63 million, or .5 percent of the V–22 budget. The project has received bipartisan support—the Armed Services Committee and the Appropriations Committee have provided funding since 1988, during both Democratic and Republican-controlled Congresses.

The DP–2 project has faced many technical challenges, as should be expected for revolutionary technology. I look forward to hearing about some of those challenges today, as well as the potential benefits of the project to our troops on the ground.

Chairman MILLER. Thank you, Mr. Hall. I respect you, too. Another Member I respect is our distinguished Chairman, Bart Gordon, who has joined us. Mr. Gordon, do you have an opening statement? Okay. Thank you.

I ask unanimous consent that all additional opening statements, or any additional opening statements submitted by Committee Members be included in the record. And without objection, it is so ordered.

And Mr. Hunter, we do want to be respectful of your time, but before we begin with the testimony, I would like for the Members to see three videos that have all been provided by duPont Aerospace to the Committee. The first is a promotional video that is actually a computer-generated simulation, although it is not identified as such, it is that, of what duPont aspires to, what his ambition is with respect to the DP–2.

And the second and third videos are of takeoff attempts, or of attempts by duPont to hover the DP–2. The first one, the first video was taken in 2003, and records a very damaging accident. And the second was provided by duPont as an example of one of its best hovers. And without objection, the transcript of the first video, which does have a voiceover, will be placed in the record.

Mr. HALL. Will the gentleman yield?

Chairman MILLER. I yield.

Mr. HALL. I duly agree that the hovering is a major thrust now, and the difference in the technologies that have been performed. That is my opinion. I would just be honored to have yours.

Chairman MILLER. I am sorry. Say that again.

Mr. HALL. The hovering aspect of it is the difference in the two, in this and the Osprey. Or one of the major differences.

Chairman MILLER. I am not certain of the major differences. I know that the Osprey also aspires to be a vertical takeoff. It is probably correct that this is an attempt to be more like a helicopter.

Mr. HALL. I am just trying to help you.

Chairman MILLER. Well, thank you. I certainly appreciate the Ranking Member's help. If we could now show the videos.

[Videos]

Chairman MILLER. Thank you. We have been joined by Mr. Sensenbrenner, who I understand does not have an opening statement, but I would wish to welcome him.

And now, before our first witness, again, Mr. Hunter, I would like to place in the record a book of exhibits, which I understand the Minority staff has seen. And it will be referred to from time to time throughout the hearing. So, without objection, that is so ordered. [See Appendix for exhibits.]

Our first witness today is the Honorable Duncan Hunter. He is currently the Ranking Member, and is formerly the Chair of the Armed Services Committee. Mr. Hunter has been a long time supporter of the DP–2. Mr. Hunter asked to be a witness today.

And Mr. Hunter, your written statement will be placed in the record. Please proceed.

Panel I:

STATEMENT OF HON. DUNCAN HUNTER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CALIFORNIA; RANKING MEMBER, COMMITTEE ON ARMED SERVICES

Mr. HUNTER. Mr. Chairman, thank you, and I wanted to come over here representing the Armed Services Committee, and explain to you why we funded this program, what it does, what the justification is.

You folks have funded, I think, roughly 10 percent of the $63 million, and you dropped out of the funding some time ago, but you are holding this hearing today, and so, I thought I would come by and tell you what we are doing and why we are doing it. And I am reminded in that little short flight you just showed of the DP–2, that as you have mentioned, the Wright Brothers, I believe their first flight was less than the wingspan on a B–1 bomber. So, if you could have shown their first flight, back in the early days, I am sure you could have evoked a couple of chuckles from loyal staff members on that one also.

Let me tell you what we are doing here, Mr. Chairman. If you look at the vehicle on the left, that is a CH–46, last built 1971. It goes extremely slow. That is what your Marines and your special operators are using in Afghanistan and Iraq today. It has had a lot of crashes, but we are all familiar with those. It is vulnerable to ground fire. It has got a relatively short range, and it has a slow speed, 165 miles an hour. We are going to replace it this year, starting the replacement in Afghanistan and Iraq, with that plane. That is the V–22, and we have spent now $11.3 billion developing that aircraft. That aircraft will go, as you can see, a little under 300 miles an hour. It will have a little over 450 nautical miles, in terms of range. It still has, and we can't get into classified data, but it is not a small target for enemy surface-to-air missiles nor for ground fire.

Now, it is in our interests to have a transport that allows Marines and special operators to move quickly from Point A to Point B, whether Point A is a tarmac at a base, or an aircraft carrier. And in this day and age of precision munitions and extremely sophisticated surveillance equipment on the part of our adversaries, we can understand that runways are going to be going out of business very quickly in a real shooting war, because you can drop precision systems on them with submunitions. You can pockmark the runways, and having a vehicle which will take off V/STOL is a real advantage to American forces and saves lives. Being able to move that aircraft quickly through vulnerable areas where surface-to-air missiles and ground fire are prevalent is also something that saves lives. So, you are moving from the antiquated CH–46 to V–22, and that V–22, again, goes about 450 miles per hour.

Now, this research project, and again, Defense Advanced Research Projects Agency is the DOD agency that has been working this program, along with the Office of Naval Research, not Production, but Research, is developing DP–2. Now, let us see what it does.

You move the CH–46, goes 165 miles an hour. V–22 doubles that, and the DP–2, if successful, will more than double the V–22, go twice as fast as V–22, four times as fast as CH–46. Whereas you have a 10,000 foot ceiling on CH–46, you have got a 25,000 foot for V–22. You have got a 45,000 foot for DP–2. Max range, you go from 120 nautical miles, very short legs on that bird, 450 for V–22, 2,500 for DP–2.

Now, Mr. Chairman, you pointed out that there have been criticisms of this program. Let me give you a good poker hand. These are just a few of the criticisms, all of which claim that they justify termination of the V–22 program, and if you look up at the board there, you will see some of these extremely critical statements of V–22, stating that it has lots of problems, has overruns, is a—how much time do I have left, Mr. Chairman? That looks like——

Chairman MILLER. Don't worry about it. Keep on going.

Mr. HUNTER. Okay. Thank you. Stating that it has lots of problems, that it is overrunning costs, that it should be canceled. You had several major problems, like the vortex ring state, that was discovered after some 19 Marines died at Yuma in a catastrophic crash. You have, also, the inability for this vehicle to autorotate. Nonetheless, we put the V–22 into production because we need it, because it does this: it doubles the speed and therefore, the time of vulnerability of the CH–46; it more than doubles the range of the CH–46; and it means we are going to have more Marines and more special operators alive after they run their operations than if you were using the CH–46.

Now, a question. You mentioned we spent a lot of money on this, on the DP–2, $63 million. We have spent $11.3 billion on V–22. That means that for every dollar you spent on V–22, which is just now getting fielded, and this is for research, you spent less than half a penny, and we funded that out of the Armed Services Committee primarily, you guys did 10 percent of it, on the DP–2.

Now, you have mentioned that this has taken a long time, 19 years. V–22, the vehicle in the middle, took 25 years. Nobody complained. And you mentioned the time it took the Wright Brothers to get their first flight. Mr. Chairman, let me tell you, there is not a bird on the runway today, I am talking B–1, B–2, Joint Strike Fighter, F–16, F–15, that we developed in four years. You don't develop anything in four years any more.

And here is a key aspect to DP–2 that is important for this country to acquire, and that is the aspect to vertically take off without a runway. Now, let me just say, and we have got the typical group of folks who will be critics of this program, but anybody can be critical of a V/STOL program, because V/STOL is very hard to achieve.

We have one V/STOL aircraft today in the inventory. It is called the Harrier. That is what the Marines fly. To date, the Harrier has crashed 33 percent of its aircraft. We have had, I believe, up through 1998, I believe 44 fatalities with the Harrier. With V–22, you mentioned, you said that DP–2 is dangerous. The V–22, which is going into production now, will be fielded later this next year in Afghanistan and Iraq has claimed the lives of 30 Marines. V/STOL is a very, very difficult to establish. It is very difficult, and it is very expensive, and let me give you the last example of that.

We are spending billions on the Joint Strike Fighter right now. The Joint Strike Fighter has a V/STOL variant, because everybody understands being able to operate without a runway is an enormous advantage to our Marines and our special operators. Now, you showed your picture of this little aircraft not getting off the ground, and we have spent $63 million. Let me give you one back, Mr. Chairman. We have spent over a billion on Joint Strike Fighter, and that V/STOL version hasn't left the ground one inch. It hasn't even gone up five feet and fallen back down. It has not left the ground. So, the point is that V/STOL is extremely difficult to achieve, but it is extremely valuable. If you have V/STOL in an aircraft that can pick up a special operations team in Afghanistan or Iraq without having to have a runway, without having to move them down in an exposed way to an area that obviously is targeted by the enemy, because runways stand out, big, loud, and clear, especially with modern surveillance capability, if you can pick them up in a clandestine manner, with a minimum of exposure, you are ensuring that a lot more of them are going to come back alive than otherwise. That is why having V/STOL capability is important. That also means you can operate your V/STOL aircraft off Marine LPDs and LHAs. That is the Marine landing ships, which presently accommodate helicopters.

So, we all agree that V/STOL is important. It is hard to achieve, and let me show you one last thing, Mr. Chairman, just so everybody understands the full measure of what we have got here. You now have this in context. We have got the ancient CH–46. It is being replaced by the more modern V–22, which has a myriad of problems, by the experts, by guys like the folks sitting behind me, lots of whom say kill it, lots of very derogatory things said about the V–22, but it is a lot better and a lot faster than CH–46. Let me show you what the Department of Defense has done with respect to finding a follow-on to the V–22. Flip that chart over.

There is nothing on that chart, obviously. That is because DOD has nothing. They have come up with nothing. Sometimes, DOD comes up with nothing. Last year, when we looked at our Marines, who were out on patrol in Iraq, we said do they have a portable jammer that will allow them to jam roadside bombs or bombs that are in villages as they are on patrol, something a man can carry in a backpack form. Nothing. The Pentagon had not come up with a single system.

The Armed Services Committee, the same group that was working on DP–2, came up with a small, portable jammer about as big as a big battery. We produced 10,000 of those under Congressional direction in 70 days, and got them into the field to protect our people. Now, the idea around here that if the Pentagon doesn't come up with something, that if the services don't like it, you are not going to build it, is ridiculous.

You know, Billy Mitchell, if we are talking about aircraft history, Billy Mitchell invented the idea that planes could sink ships, and we court-martialed him for his impudence, and of course, the Navy hated him ever after. I think we are going to get him a second star this year, because there is nobody left that hates him for that. The point is, the Pentagon doesn't come up with every great idea. This year, in the Armed Services Committee, we added on, earmarked, if you will, $400 million for additional force protection for our troops in field, including stuff for IEDs, for roadside bombs, for incoming mortars. It is our job, under the Constitution, to provide for the equipment and the maintenance of the Army, the Navy, and of course, by implication, the Air Force. We do that.

Now, we only have a chance of DP–2 working, and I know people are going to come up, and they are going to talk about problems they have had with the company. You will have the classic disgruntled employee who will tell about his problems with the company. That story could be told on every single weapons system that is fielded today. And what I am telling you is we need to move ahead on a V/STOL technology with a reduced cross-section, so you don't have surface-to-air missile problems to the degree that you have them with CH–46 and V–22, with high speed and long legs. And I think one half a penny on the dollar that we have spent for V–22, one half a penny out of that dollar, going to a new follow-on technology, is well worth it.

So, Mr. Chairman, thank you for letting me come and talk to you a little bit today, and I stand ready for any questions.

[The prepared statement of Mr. Hunter follows:]

PREPARED STATEMENT OF THE HONORABLE DUNCAN HUNTER

Chairman Miller and Ranking Member Sensenbrenner, thank you for giving me this opportunity to share my thoughts regarding the DP–2 Vectored Thrust Aircraft, a science and technology program funded by the Office of Naval Research.

The DP–2 project represents potential leap-ahead technology to support our Marines and Special Forces operators. The project has been supported by a number of Members of Congress over the years, and I have been a strong supporter from the outset. The project has received bipartisan endorsement, as the Armed Services Committee and the House Appropriations Committee have provided funding for DP–2 since 1988, during both Democratic and Republican-controlled Congresses.

The project has experienced quite a few technical challenges, but should it be successful, it could provide superior capabilities for our armed forces in terms of the speed, range, and stealth capability of our transport aircraft. Moreover, it is not uncommon for aviation technology to require significant resources and time to mature. In fact, the V–22 aircraft, which will be deployed in combat for the first time this year, is based on the XV–15 tilt-rotor prototype that was first flown in 1977. Research and development expenditures for the V–22 total more than $11.3 billion. The investment in DP–2 represents pennies on the dollar to expand the scientific knowledge-base for vertical takeoff and landing, or VTOL, aircraft and its continued funding will be re-evaluated annually depending on future progress.

As a Member of the Committee on Armed Services, and particularly as the Committee's former Chairman and current Ranking Member, I am fortunate to be briefed on a variety of military technologies that may result in improved war-fighting capabilities. Likewise, I am privileged to talk regularly to the men and women of our armed forces to get a better understanding of the true capabilities and limitations of their equipment and areas of continued need. One of the key lessons I have learned is that not everything our armed forces need is captured as a validated requirement by the Department of Defense. Similarly, not every good idea to address war-fighting needs comes out of the Pentagon or large defense companies. By nature, the personnel who manage acquisition programs within the Department of Defense are risk-adverse. Their performance is not measured in terms of innovation, but rather in terms of delivering capabilities on-cost and on-schedule. The fate of large defense companies usually rests in the success, or otherwise, of the multi-billion dollar programs with which the companies are associated. As a result, I have found that most innovative concepts emerge from small companies that operate outside of the defense establishment.

In the late 1980's, as the Cold War began to draw to a close, and the face of our enemy began to change, I became concerned about the military's ability to insert or extract Marines and Special Operations Forces (SOF) in parts of the world without robust infrastructure such as runways and air bases. In short, we needed an aircraft that could land and take off vertically like a helicopter, but fly with the speed of a jet with the capacity of a transport. At the time, we had the Harrier, a fighter jet that had done and would continue to do yeoman's service for the Marine Corps, but it was a fighter, not a transport. It had been upgraded to the AV–8B in the early 1980's after being in inventory for decades. But our options in terms of transport aircraft, that could hold several combat loaded Marines or SOF, were limited. For example, we had the CH–46 Sea Knight, which was aging—even at that time. The last CH–46 had gone into production in 1971, and has a maximum speed of 165 miles per hour (mph). The V–22 Osprey, a tilt-rotor aircraft that would go faster and farther with more payload than the Sea Knight, was in development, but its future was unclear. Around that time, I learned about a small company called duPont Aerospace and a concept they had for a VTOL transport aircraft using jet engines. It was an unusual and risky approach from a technological perspective, but I believed that the concept warranted further development. As a result, in 1988 I requested, and the Armed Services and Appropriations Committees granted, the first earmark for the program.

In terms of earmarks, let me say this. Members of Congress and particularly Members of the Armed Services Committee take their constitutional responsibility to, "raise and support armies. . .to provide and maintain a navy, and to make rules for. . .the land and naval forces," very seriously. Every year the Armed Services Committee receives letters from nearly every Member of this body, which represent our Members' efforts to share their ideas for the best ways to fulfill this responsibility. The Committee evaluates these requests and our Members are given three opportunities to amend and to vote on the requests included in our bill—at the Subcommittee level, Full Committee level, and on the House Floor. As Chairman, and now Ranking Member, of the Armed Services Committee I cede my constitutional responsibility to nobody, least of all the Pentagon. While some may cast aspersions on earmarks, I guess you could call it earmarking when I added more money to the President's budget request for up-armored Humvees. I also added money to the budget for portable jammers that our soldiers and Marines could wear during dismounted operations. For that matter, we've added funds for body armor and have been relentless in our pursuit of alternative technologies and the development of testing standards. We have saved American lives with these earmarks, and I am proud of them.

Beyond force protection, I have added money for some of these innovative, but risky, technologies that I have described previously. Although the Pentagon may not have a firm requirement for something and may not have requested funds for it, my job is to listen to our war-fighters, to set a vision, and to help the war-fighter get the best tools possible to do his or her job. I am willing to take some risks to get there. Consequently, I have funded programs such as the X–Craft, or Seafighter, a ship sized to operate at high speeds in shallow waters with minimal manning. A lot of people said it couldn't be done, but today it is the fastest ship in the Navy and can be operated with a crew of only 26.

The DP–2 program falls into the same category. Its inventor estimates that the DP–2 can operate at maximum speeds of 724 mph. If successful, it would be the fastest VTOL transport aircraft in the world, operating at more than twice the maximum speed of the V–22, which can only operate at 316 mph. It is absolutely true that the DP–2 program has had and continues to have a number of significant technical challenges. As a result, it has quite a few detractors. Inevitably, new concepts and programs will have such problems and will attract naysayers. In fact, the V–22 has been plagued with negative reports since its inception. Moreover, the Osprey has had several crashes, three of them fatal. I have included, for the record, a number of reports from the General Accountability Office, the defense press, and outside groups that have questioned the progress and utility of V–22. The latest such report from the Congressional Research Service is dated March 31, 2007 and details the strong opposition that V–22 still faces, despite its planned combat fielding for this year. Nevertheless, the V–22 has many supporters, and the Marines and SOF are counting on its fielding. Given such support, one would be hard pressed to argue that a technology that could deliver greater speed and greater stealth capabilities has no military utility and is not worth some investment. Every moment the presence of those Marines or those commandos is known and every moment they are in the air at low altitude, is a moment their lives are in danger.

My own son is a Marine who has served twice in Iraq and is now back in Afghanistan. If I can help foster the next generation of technology that will carry men and women like him out the line of fire from shoulder launched weapons or similar devices, I will do it. To put this is some perspective, the investment we have made in DP–2 is less than one percent (0.6 percent, to be precise) of the investment we have made in V–22 to date. Granted, should the science behind DP–2 prove successful, it will require additional investment. But I consider the investment prudent from a financial and risk perspective.

In closing, it is the Armed Services and Appropriations Committees' job to consider where to place such investments in military science and technology, just as it is our responsibility to recommend cuts to programs that are no longer worth pursuing. We will continue to exercise our best judgment on the potential for this technology in the coming months and years. We look forward to any insights this committee may have to share with us.

Thank you.

DISCUSSION

Chairman MILLER. I do have one. Mr. Hunter, you undoubtedly know vastly more about experimental military aircraft than I do. I respect your service; I respect your expertise, but we all have to deal with a great many topics here. There are topics before Congress on which I actually know more than any other Member, but when Members are in a room discussing those issues, I quickly understand, recognize that I am the one-eyed man in the valley of the blind, and that there are people who do it for a living, for whom it does not get a little piece of their brain, but it is what they do, and they have expertise, and they have judgment that vastly exceeds my own, and I have learned to be humble in their presence, and to ask for their counsel, to rely upon their expertise and their judgment.

Now, I know that all of us can point to transformational great inventions that the times' skeptics said would never work. The

Wright Brothers, Billy Mitchell sinking ships with bombs from the air, the Moon landing, and in North Carolina, by the way, people who believe the Moon landing is fake and professional wrestling is real is a demographic. So, there were people who were skeptical at the time, but I have to think for every time the experts said something will never work that in fact worked, more spectacularly and changed society, there are thousands of times that the experts said this is never going to work, and in fact, it never worked.

My question is how do we make judgments when the people that I would expect that we would rely upon, whose greater expertise, whose judgment would exceed our own, are pretty unanimous, and that includes NASA, DARPA, and the private aerospace industry, all of whom have looked at this concept and said it is not going to work, and it appears that we are pretty far into this, and it is not working.

How do we make our own decisions, disregarding the unanimous decisions, unanimous judgments of people whose expertise is greater than our own?

Mr. HUNTER. Okay. Well, here is what I think we do. I think it is a matter of judgment, and I think you have got two lines here. The first line is, if you can put the poster back up, the first line is what are we fielding today, what are we going to field today that has to, by gosh, get out on the field, so those Marines can climb into a vehicle in Iraq and Afghanistan this next year that will move twice as fast as the old one, and will give them a modicum of safety over what they have had before. In this case, that is the V–22. With all of the problems I have told you about V–22, we have gone ahead with it. You know, Dick Cheney killed V–22 at one time, and everybody in the Pentagon backed him up and said we need to kill V–22, it is no good.

Congress moved ahead, you, Mr. Chairman, at least your predecessor, and Congress as a whole moved ahead. V–22 is going to be carrying Marines twice as fast as the CH–46 this year, because Congress did it. So you had a stack of experts a mile long in the Pentagon saying that V–22 was no good. Now we are moving ahead with our production project. At the same time, you have the Defense Advanced Research Projects Agency, which reaches out into the future, just like those proverbs you have got up there that say "Where there is no vision, the people perish."

That is, you go out, and you do lots of initiatives that are research initiatives, and a lot of them fail, but a few of them break through, and the ones that break through prove of great value. I was with Chuck Yeager the other day, and you know, he pointed out that just the flying tail that they developed on the X–1, just that little piece of the X–1 put us into space, and nobody else in the world had it, and that was the key to going supersonic, for five years.

So, you develop things that go over the horizon, that are for the future, for the follow-on, while you are putting out the ham and eggs production model, that 2007 Chevy is being put into the field right now. While you are putting that into the field, you are also spending DARPA money, and Office of Naval Research money, on something new. And Mr. Chairman, I am looking at two statements of your witnesses who are going to be here today. Here is one of them right here. Conclusion, by Mark Deadrick, who is going to talk to you. He says: "As a parting statement, I feel that the DP–2 program has some technical merits."

So, this isn't a case where everybody says this is absolutely no good. The problem is V/STOL is extremely difficult. V/STOL has claimed the lives of a ton of Marines. We have crashed a third of the planes that had V/STOL, and the Joint Strike Fighter didn't even get as high as that little tethered shot that you had of DP–2.

So, you have got an enormously difficult problem. The only way to solve a problem is with research. The last thing you will see by the ONR team that went out, and the NASA team that was out there seven days ago, or maybe it was about 12 days ago now, they said they think that this program has justifications, and I am quoting them exactly, it says: "We state that the independent DP–2 review panel concluded that continued hover test is warranted." One point they made was they thought that you need to have more funds if you are really going to have a robust testing program.

So, if you are asking me what is the split, well, the split is this, $11.3 billion for the production model that is going out the door, and the Marines are going to ride in next year, $11.3 billion. One half a penny for each dollar that is spent on that for a new technology that goes over the horizon.

And the last thing I would say to you is this. We ought to acknowledge you have got to have something over the horizon. You have got to have something with a smaller radar cross-section than the great big radar cross-section that V–22 has. You have got to have something that makes it harder for our guys to get hit in the sky.

So, if DP–2 is not the answer, what has the Pentagon come up with, with respect to V/STOL ability to carry lots of troops out of rugged conditions? And the answer, Mr. Chairman, that I have seen: zero. They have done the same thing they did with the portable jammer. They didn't have any portable jammer for our Marines. They didn't even have a defective one. They had none. The Armed Services Committee came up with a jammer. We forced it down their throats. We made them field in 70 days. We got 10,000 of them out there. There are Marines alive today because Congress took initiative. Congress has taken a lot of initiative. Congress forced them to have the AVAB when it was going to be cancelled. V–22 was cancelled by the Bush Administration, and Congress forced the production of V–22 because we couldn't live with CH–46 any longer.

You know, this is our Constitutional obligation. So, that is my answer to you, Mr. Chairman. You take a balance. I think half a penny on the dollar is a reasonable balance. And our intention on the Armed Services Committee is to continue to go forward with this program, and get that ground test, that this last review about two weeks ago said we should have. I think we should have the ground test.

Chairman MILLER. Mr. Hall.

Mr. HALL. Mr. Chairman, I guess I don't exactly have a question, other than I could ask you if you are through, if you have more that you would like to impart to us, but I personally apologize to you, though Chairman, I may think the most important ones on the Committee are here, and Professor Baird down here is a great addition, but I am sorry the entire Committee couldn't hear your testimony, but they will read it, because the Chairman is going to see to that.

I yield back my time.

Mr. HUNTER. Well, thank you, Mr. Hall. If I could just respond to you briefly.

I don't know if you have seen the X–Craft, but I think you should be interested in that, because it has a commercial application. We built the X–Craft as a mandate by the Armed Services Committee. The Navy hated the X–Craft. They hated the idea. They sent us regular reports, just like the ones you have got stocked up on DP–2, saying it would never work. We have built it. The X–Craft today is in the water, it is the fastest ship in the Navy by a huge margin. It is in the water, goes about 60 miles an hour. Now, you know, you have heard the Navy talk about transformation, and the need to be able to operate with small crews. This ship, that goes 60 miles an hour, has a crew of 26 sailors. You can run special operations out of it. You can run UAVs out of it. It has got its own elevator, like a small aircraft carrier. It is an outstanding ship. It is a Congressional initiative.

But once again, Mr. Chairman, all the great ideas don't come out of the Pentagon, and sometimes on things like jammers for our troops, the Pentagon has no idea, and we have to take action. I think we need to develop V/STOL capability to be able to combine V/STOL with high speed with stealth to protect American troops in what is going to be an increasingly hostile environment.

If the Pentagon thinks they have got a better idea, let them come up with a proposal. We will be happy to fund it.

Chairman MILLER. Mr. Baird.

Mr. HALL. I yield back.

Chairman MILLER. Okay. Mr. Baird. Mr. Baird has no questions. Thank you, Mr. Hunter. Okay.

Mr. HUNTER. Thank you, Mr. Chairman.

Chairman MILLER. We could take just a two minute break while the other panel takes their seats.

Thank you. I would now like to welcome our second panel.

The first witness is Mr. John Eney. Mr. Eney is the former head of the Aircraft Concept Design Group of the Naval Air Development Center, and the Naval Air Systems Command. Mr. Eney was a reviewer of the 1986 report by four other engineers on the DP–2 concept. That report concluded that there was no redeeming merit, that in the design, that there would, in the design that would justify an investment of government funds. He also led a Navy oversight team that reviewed the DP–2 program in 1999.

Dr. William Scheuren was on a DARPA review team that provided a critical evaluation of the DP–2 concept in 1990. He later became DARPA's DP–2 program manager. He is also a former commanding officer of the Marine Corps Harrier squadron.

And there seems to be an empty chair, where we would otherwise expect Mr. Martin Deadrick. He was on video. That is—okay. He is a former manufacturing engineer, manager for duPont Aerospace Company. He began as an intern, fabricating models, was a mechanical aerospace engineer from 1992 to 1994, and returned as a manufacturing engineering manager from 2002 to 2005. He was in charge of the Composite Fabrication and Assembly. Mr. Deadrick joins us via videoconference from San Diego.

It is the practice of the Investigations and Oversight Committee to take all testimony under oath. Do any of you object to taking an oath? No?

All right. Sitting on the next row.

Mr. ENEY. I am sorry. Can you repeat the——

Chairman MILLER. Do you object to taking an oath?

Dr. SCHEUREN. No, I do not, sir.

Chairman MILLER. Okay.

Mr. ENEY. No, I do not.

Chairman MILLER. All right. If you would, then, please raise your right hand.

[Witnesses sworn]

Chairman MILLER. If you want to invoke the Deity, we can.

Mr. HALL. Chairman, I would like for you to ask them to take the full oath, winding up with so help me God.

Chairman MILLER. Do any of you object to taking a religious oath?

Mr. ENEY. I do not object.

Chairman MILLER. Okay.

Dr. SCHEUREN. And I do not object.

Chairman MILLER. Mr. Deadrick.

Mr. DEADRICK. I would, but I will do it anyway, sir.

Chairman MILLER. Okay. Well, you are not required to take a religious oath.

Mr. HALL. No, Mr. Chairman, if he objects, I would rather not hear it. If he has any objection to it, if he doesn't want to take that, so help me God, then I don't, I neither want him to take the oath, nor do I want to listen to him.

Chairman MILLER. We will take Mr. Hall's objection under advisement, but Mr. Eney and Dr. Scheuren, who have not objected to a religious oath, as requested by Mr. Hall, would you stand again?

[Witnesses sworn]

Chairman MILLER. Okay. Okay. And for all the witnesses, the same expectation of truthfulness applies, and the same penalty of perjury applies. I certainly hope that this committee never refers a case for prosecution, but there is absolutely no difference in the legal requirement of an oath taken invoking a deity, and an oath taken not invoking a deity.

Okay. All right. All right, you will also have the right to be represented by an attorney. Do any of you have an attorney with you?

Mr. ENEY. I do not.

Dr. SCHEUREN. I do not.

Mr. DEADRICK. I don't.

Chairman MILLER. Okay. And now, each of you have five minutes for your spoken testimony. Your written testimony has been included in the record already, and when the three of you have completed your testimony, we will begin with questions. Each Member will have five minutes to question the panel.

Mr. Eney, we will start with you.

Panel II:

TESTIMONY OF MR. JOHN A. ENEY, FORMER HEAD, AIRCRAFT CONCEPTUAL DESIGN BRANCH, NAVAL AIR DEVELOPMENT CENTER AND NAVAL AIR SYSTEMS COMMAND

Mr. ENEY. Thank you, Mr. Chairman and Members of the Committee. All of my exposure to the duPont Aerospace DP–2 aircraft project took place during my 35 years of full-time career employment with the Department of the Navy, in the position of Supervisory Aerospace Engineer specializing in the fields of aircraft design, experimental development, and flight testing.

The graduate level coursework I completed at Princeton University in 1965 and 1966 for my Master's degree in aerospace engineering included a concentration in the theory and design of vertical takeoff and landing aircraft, and more specifically, in the flight stability and controllability of those aircraft when operated by human pilots.

My initial exposure to the DP–2 occurred in approximately 1985, when I had just been promoted into the position of Head, Aircraft Conceptual Design Branch at the Naval Air Development Center, or NADC, in Warminster, Pennsylvania. My group of roughly 30 aerospace engineers conducted, among other duties, analytical evaluations of both solicited and unsolicited technical proposals for development of new aircraft concepts with possible application to the missions of the United States Navy and the Marine Corps.

My introduction to the DP–2 was in reading a just completed detailed analytical evaluation of the DP–2 concept that some of my senior engineers in my group had participated in, along with others from the Naval Air Propulsion Center in Trenton, New Jersey, just across the Delaware River from NADC. That formal analytical evaluation of the duPont DP–2 proposal was ordered by and funded by the then Under Secretary of Defense for Research and Engineering, in response to high level Congressional interest in the duPont proposal.

I, myself, did not get to play a direct part in that 1986 proposal evaluation, except as a reviewer. There were 20 specific technical conclusions at the end of that report, stating that the DP–2 design concept was deficient in its ability to generate enough jet engine thrust to hover in flight, that it lacked the means to control it in hover, if in fact, hover was ever achieved, and that the entire DP–2 conceptual design was far less attractive than any other competing proposed designs then being considered for Navy and Marine Corps mission applications.

In short, this 1986 formal technical evaluation of the DP–2 rejected the concept outright on technical grounds, and found no redeeming merit that would justify investment of government funding at that time.

In July of 1996, ten years later, I and my entire engineering group were relocated to new facilities at the Naval Air Station, Patuxent River, Maryland, as a result of the recommendations of the 1991 Base Realignment Advisory Commission, or BRAC. In that new location, I was promoted to a Division Head, GS–15, and my Advanced Conceptual Design group was elevated to a Division, which included counterparts from the Crystal City, Virginia headquarters of the Naval Air Systems Command that had also been relocated to new facilities at Patuxent River.

In February of 1999, I received formal notification from the Navy Admiral and Commander of the Naval Air Systems Command that he had just been visited by then Navy Captain John Kinzer, to review an ongoing contract between the Office of Naval Research and duPont Aerospace. When former F–14 project test pilot Captain Kinzer arrived at ONR, his new duty station, and was confronted by the DP–2 project in being, he reported the situation to the Admiral back at NAVAIR. The entire NAVAIR engineering staff was briefed on the DP–2 project by Captain Kinzer, and the Admiral commanding NAVAIR recommended that a hand-selected team of 11 senior civilian specialists in aircraft research, design, test evaluation, or RDT&E, be placed under my leadership for the on-site review at duPont Aerospace facilities near San Diego, which took place on March 8 and 9 of 1999.

Those senior specialists who accompanied me on that two day review were from the following specific fields in the NAVAIR organization: aircraft design, test and evaluation; propulsion system installation and test; airframe structures; airframe materials; flight controls; flight dynamics; aircrew escape systems; and flight test clearance. The team conducted their onsite review at the duPont engineering facilities at La Jolla, and the duPont manufacturing hangars at Gillespie Field in El Cajon.

The DP–2 was, at that point in time, less than 50 percent assembled. Each member of the evaluation team was allowed to closely inspect the partially built DP–2, and interview the various engineers and technicians on the project who were employed by duPont Aerospace. A rudimentary computerized flight simulator, supposedly programmed with the handling characteristics of the DP–2, was demonstrated to the team by the duPont company test pilot, who had been a Marine pilot flying the AV–8 Harrier VTOL jet fighter. This company pilot was not a graduate of either the Navy or Air Force Test Pilot Schools.

All team members submitted written detailed assessments of their particular aspects of the DP–2 project to me within one week of returning to our offices at NAVAIR at Pax River. I then submitted a composite written team report as a cover letter, with all of their individual reports attached, to the NAVAIR Commanding Admiral. The opinions of the entire group were unanimous in expressing grave concerns over the design, fabrication, and proposed testing of the DP–2. The mechanization of the elaborately articulated thrust-vectoring system was firmly predicted by the team to destroy itself when subjected to the heat and thrust of the twin-jet engine exhaust.

The company-estimated aerodynamics and handling characteristics of the DP–2 were inadequately substantiated by any routine means such as wind tunnel testing and the computation of inertial properties of the completed airplane. This meant the company pilot was being "trained" to fly a totally undefined computerized airframe on the so-called DP–2 flight simulator.

In overview, our March 1999 NAVAIR assessment of the ongoing DP–2 was as follows. Point number one, the DP–2 design that was first rejected by a totally different team of Navy engineering specialists back in 1986 had not significantly changed in 13 years, in the eyes of we newcomers in 1999.

The propulsion thrust-vectoring system, consisting of two turbofan engines placed closely together at the nose of the airplane, plus an array of articulated vanes, was predicted to break up structurally when employed to lift the DP–2 in a vertical takeoff or landing attempt.

There was a significant lack of control devices, such as attitude control puffer jets on the tail and wingtips, that were absolutely necessary to maintain piloted control of the DP–2 in low speed forward flight, hover, and in vertical takeoff and landing. At that time, the company, the duPont Aerospace Company, maintained that such control would be provided by the variable vanes in the thrust-vectoring system, which we considered a highly suspect concept.

The lack of adequate hover control flies in the face of the company-advertised scheme, shown in the videos this morning, of having squads of equipment-laden Special Forces troops running the length of the fuselage and rappelling down ropes strung from the open tailgate. I didn't see that scene in this morning's video, but that is in the published literature brochures of the company.

This testing of the DP–2, if continued, should be performed unmanned, through remote control, in a desert test range environment, well away from bystanders and valuable structures, if you choose to continue testing at all.

In summary, Mr. Chairman and Members of the Committee, I wish to stress that the DP–2 proposal was summarily rejected by impartial, experienced engineers and scientists from government aeronautical laboratories of not only DOD, but also NASA, repeatedly over the past 20 years, yet it was forcibly funded and undertaken at the insistence of Congressional advocates, with no regard to the judgments of their own government laboratory experts.

The DP–2 is not the first such ill-advised aircraft project, and it is not the only one ongoing now. At least one other, that I had painful personal experience with, resulted in a predicted catastrophe and fatality, all for no resulting technical gain.

In my personal opinion, Mr. Chairman and Members of the Committee, as a retired federal employee, I am not speaking for the United States Navy in this statement, the DP–2 concept has no practical application to the advertised military or civil roles touted by the contractor.

Again in my personal opinion, to continue to fund it would be an insult to the aerospace industry at large and to the taxpayers.

Thank you for this opportunity.

[The prepared statement of Mr. Eney follows:]

PREPARED STATEMENT OF JOHN A. ENEY

Abstract

The DP–2 aircraft development project proposal was evaluated and summarily rejected on technical grounds by aircraft design experts from the aeronautical laboratories of the Department of Defense as well as NASA in the mid 1980s, yet it was funded, and the contract was awarded to the duPont Aerospace company at the insistence of congressional advocates. A Navy team of senior engineers and scientists performed a second evaluation of the partially built DP–2 in 1999, and again, it was summarily rejected on technical grounds. The DP–2 design fails to embody the

means to demonstrate the tactical military advantages advertised by the manufacturer, and no technological remedy for its failings is evident.

All of my exposure to the duPont Aerospace DP–2 aircraft project took place during my 35 years of full-time career employment with the Department of the Navy in the position of Supervisory Aerospace Engineer, specializing in the fields of aircraft design, experimental development, and flight testing. I first entered that employment having two degrees in engineering, as stated in my accompanying resume. The graduate level course work I completed at Princeton University in 1965–66 for my Master's Degree in Aerospace Engineering included a concentration in the theory and design of vertical takeoff and landing (VTOL) aircraft, and more specifically, in the flight stability and controllability of those aircraft when operated by human pilots. My Master's thesis relied directly upon in-flight testing of an experimental aircraft capable of having varying degrees of stability and controllability, sponsored under a Princeton University research contract from the Navy.

My initial exposure to the DP–2 occurred in approximately 1985 when I was promoted into the position of Head, Aircraft Conceptual Design Branch, Naval Air Development Center (NADC), at Warminster, PA. My group of roughly (30) aerospace engineers conducted, among other duties, analytical evaluations of both solicited and unsolicited technical proposals for development of new aircraft concepts with possible application to the missions of the Navy and Marine Corps. These proposals came to our attention from sources that ranged from major aircraft manufacturing companies to small children interested aviation. It was Navy policy that we respond in writing to each proposal within thirty days. My introduction to the duPont DP–2 was in reading a just-completed detailed analytical evaluation of the DP–2 concept that some of my engineers had participated in along with others from the Naval Air Propulsion Center in Trenton, NJ. That formal analytical evaluation of the duPont DP–2 proposal was ordered by, and funded by, the Under Secretary of Defense for Research and Engineering, in response to high-level Congressional interest in the duPont proposal. No other unsolicited proposals that came our way prior to that had ever been given such high-level attention. The NADC evaluation was reported in writing by (4) senior engineers, one of which was my predecessor Branch Head, and another of which was a continuing member of my group. I myself did not get to play a direct part in that proposal evaluation, except as a reviewer. The 36-page report was issued as NADC–86069–60, "An Assessment of the duPont Aerospace Company Model DP–2 V/STOL Aircraft Design," in May, 1986. There were (20) specific technical conclusions at the end of that report, stating that the DP–2 design concept was deficient in its ability to generate enough jet engine thrust to hover in flight, that it lacked the means to control it in hover (if hover was ever achieved), and that the entire DP–2 conceptual design was far less attractive than other competing proposed designs then being considered for Navy and Marine Corps mission applications. In short, this 1986 formal technical evaluation of the DP–2 rejected the concept outright, and found no redeeming merit that would justify investment of government funding at that time.

It is important to put this 1986 evaluation in proper perspective. Those performing the study were dedicated civil service engineers with a wealth of lessons learned over previous decades of experimental V/STOL aircraft programs performed by NASA as well as by DOD and foreign governments. They had no prior awareness of either duPont Aerospace as a company, or the DP–2 as a concept that might have prejudiced them. They would have found no material gain in rejecting the concept. Contrarily, they would have stood to gain future project oversight funding for the Navy to proceed with a contract award for the DP–2 development.

I had no further involvement with the DP–2 concept between May 1986 and February 1999. During that interim, there were occasional reports in the aviation news media that the DP–2 proposal was bouncing from agency to agency in the U.S. Government. Informal dialogue with our counterparts in the aircraft design research groups at NASA and the Air Force, as well as the Army, revealed that similar negative assessments were being reported to their superiors, and ultimately to the congressional proponents of the DP–2.

In July of 1996, I and my entire engineering group were relocated to new facilities at the Naval Air Station, Patuxent River, MD, as a result of the recommendations of the 1991 Base Realignment Advisory Commission (BRAC). In that new location, I was promoted to a Division Head (GS–15) and my Advanced Conceptual Design group was elevated to a Division which included counterparts from the Crystal City, VA, headquarters of the Naval Air Systems Command (NAVAIR).

In February of 1999, I received formal notification from the Navy Admiral and Commander, NAVAIR, that he had just been visited by Navy Captain John Kinzer, to review an ongoing contract between the Office of Naval Research (ONR) and du-

Pont Aerospace. The DP–2 was being built, and had been under construction for some time. The Admiral directed that I form and lead a panel of senior NAVAIR engineers from various fields of technical specialization, to conduct a two-day on-site review of duPont Aerospace facilities near San Diego, CA, and assess the ongoing design and construction of the DP–2. In meeting with Capt. Kinzer myself, I learned that he was newly assigned to ONR in Ballston, VA, to be assistant program manager for the DP–2 contract. The ONR Program Manager himself at that time was Dr. Tom Taylor, an SES civilian, now deceased. In a later meeting at ONR with Dr. Taylor, I was informed as to how the DP–2 contract had come into being without the awareness of NAVAIR, who was chartered to manage all aircraft design and development conducted by or for the Navy and Marine Corps. I would soon come to learn that congressional proponents of the DP–2 had earmarked funding for the initial contract and directed the funds to the Defense Advanced Research Projects Agency (DARPA) in Rosslyn, VA, to award and manage the DP–2 contract. I was told that DARPA had refused to accept the funds and rejected the DP–2 concept on technical grounds. ONR, in the person of Dr. Taylor, stepped into the fray and informed the Congress that if the DP–2-earmarked funds were redirected to ONR, he would gladly manage the project with duPont, as desired by the proponents on the Hill.

When former F–14 project test pilot Captain Kinzer arrived at ONR and was confronted by the DP–2 project in being, he reported the situation to the Admiral at NAVAIR. The entire engineering staff at NAVAIR was briefed on the DP–2 project and a hand-selected team of (11) senior civilian specialists in aircraft research, design, test and evaluation (RDT&E) were placed under my leadership for the on-site review at duPont Aerospace facilities near San Diego which took place on March 8–9, 1999. Those senior specialists were from the following fields in the NAVAIR organization—Aircraft Design, Test & Evaluation, Propulsion Installation and Test, Airframe Structures, Materials, Flight Controls, Flight Dynamics, Aircrew Escape Systems and Flight Test Clearance. The team conducted their on-site review at the duPont engineering facilities at La Jolla, and the duPont manufacturing hangars at Gillespie Field in El Cajon. The DP–2 was, at that point in time, less than 50 percent assembled. Each member of the evaluation team was allowed to closely inspect the partially built DP–2, and interview the various engineers and technicians on the project who were employed by duPont Aerospace. A rudimentary computerized flight simulator supposedly programmed with the handling characteristics of the DP–2 was demonstrated to the team by the duPont company test pilot who had been a Marine pilot flying the AV–8 Harrier VTOL jet fighter. This company pilot was not a graduate of either the Navy or Air Force Test Pilot Schools.

All team members submitted written detailed assessments of their particular aspects of the DP–2 project to me within a week of returning to our offices at NAVAIR, Patuxent River. I submitted a composite written team report, with all their individual reports attached, to the NAVAIR Admiral. The opinions of the entire group were unanimous in expressing grave concerns over the design, fabrication, and proposed testing of the DP–2. The mechanization of the elaborately articulated thrust-vectoring system was firmly predicted to destroy itself when subjected to the heat and thrust of the twin-jet engine exhaust. The company-estimated aerodynamics and handling characteristic of the DP–2 were inadequately substantiated by any routine means such as wind tunnel testing and computation of inertial properties of the completed airplane. This meant that the company pilot was being "trained" to fly a totally undefined computerized airframe on the so-called DP–2 flight simulator. The use of composite material shells for the airframe structure was being undertaken without any adequate fixtures to insure proper alignment.

I, myself, was extremely disturbed by the planned testing of the DP–2 situated on the public commercial airport, Gillespie Field in El Cajon, CA. We were shown a completed elevated steel platform on which the DP–2 was to be strapped down for testing of the thrust vectoring system. That platform was permanently located on the public airport property, less than 30 feet from the chain-link fence on the boundary between the airport property and a public thoroughfare including sidewalks, offices, and automobile parking in the city of El Cajon. The risk to off-airport property and pedestrian traffic was immense and of little apparent concern to duPont Aerospace management. Also disturbing was the stated intent to fit the DP–2 cockpit with a pilot emergency ejection seat taken (by suspect means) from a Navy F–14. That "free gift" F–14 ejection seat was simply plopped into the DP–2 cockpit area with over a foot or more of the seat head box structure protruding well above the top of the enclosed cabin structure. This was unexplained by the duPont management when challenged.

In overview, our March 1999 NAVAIR assessment of the ongoing DP–2 was as follows:

- The DP–2 design that was first rejected by a totally different Navy engineering team back in 1986 had not significantly changed in thirteen years, in the eyes of us newcomers.
- The propulsion thrust-vectoring system, consisting of two turbofan engines placed closely together at the nose of the airplane, plus an array of articulated vanes, was bound to break up structurally when employed to lift the DP–2 into a vertical takeoff or landing.
- There was a significant lack of control devices, such as attitude control "puffer" jets on the tail and wingtips, that were absolutely necessary to maintain piloted control of the DP–2 in low forward speed, hover, and in vertical takeoff and landing. The company maintains that such control would be provided by the variable vanes in the (highly suspect) thrust vectoring machinery.
- The lack of adequate hover control flies in the face of the company advertised scheme of having squads of equipment-laden Special Forces troops running the length of the fuselage and rappelling down ropes strung from the open tailgate.
- The testing of the DP–2, if continued, should be performed unmanned, through remote radio control, in a desert test range environment, well away from bystanders and valuable structures.

In summary, I wish to stress that the DP–2 proposal was summarily rejected by impartial engineers and scientists from government aeronautical laboratories of DOD and NASA repeatedly over the past twenty years, yet it was forcibly funded and undertaken at the insistence of congressional advocates, with no regard to the judgments of their own government laboratory experts. The DP–2 is not the first such ill-advised aircraft project, and it is not the only one ongoing now. At least one other that I had painful personal experience with resulted in a predicted catastrophe and fatality, all for no technical gain.

BIOGRAPHY FOR JOHN A. ENEY

Mr. Eney was born in Baltimore, MD, June 20, 1942 and received a Bachelor of Science in Mechanical Engineering from Catholic University, Washington, DC, in 1964, and a Master of Science in Aerospace Engineering from Princeton University, Princeton, NJ, in 1966. His graduate study at Princeton included courses and in-flight research in the flight dynamics and control of aircraft, and his Master's thesis research was sponsored by the U.S. Navy under contract to Princeton University.

Mr. Eney worked for the Department of the Navy for 35 years (1966–2001) as a Supervisory Aerospace Engineer until his retirement in October, 2001. From 1986 through 2001 he served as the Head of the Aircraft Conceptual Design Group, first at the Naval Air Development Center (NADC) in Warminster, PA, and finally at the Naval Air Systems Command (NAVAIR), Patuxent River, MD. His staff of 17–30 engineers analytically determined the size, weight, configuration, and performance of tentative new aircraft for Navy and Marine Corps missions. This included computer-aided design of fixed-wing airplanes, helicopters, lighter-than-air airships, and hybrid vertical take-off and landing (VTOL) aircraft. His work included the preparation and development of trade studies, and the specifications for competitive procurement of aircraft from the manufacturers in the industry. His group was responsible for evaluating all solicited and unsolicited proposals for new aircraft designs coming in to the attention of the Navy Department. He and his staff also attended on-site reviews of independent research and development projects throughout the aircraft industry, as well as at other aeronautical laboratories of the U.S. Government, including NASA and the Air Force.

In 1983–1985 Mr. Eney was assigned to the Special Projects group at NADC and charged with planning the product improvement program for the F/A–18 Hornet fighter airplane and its associated weapons and sensor systems. This involved a survey of all operating Navy and Marine squadrons flying the F/A–18 to assess needed improvements, and reviews of all emerging technologies in industry that applied to advanced fighter aircraft. His summary report led to the procurement of the subsequent F/A–18C, D, E and F models for the Navy, Marine Corps, and foreign governments.

From 1975–1983, Mr. Eney headed up the Navy's Lighter-Than-Air Project Office, exploring alternative hybrid airship design concepts for applications to ocean surveillance and short-haul heavy-lift cargo transport. He briefed the Senate Committee on Commerce, Science, and Transportation on the feasibility of modern airships in 1979.

Between 1966 and 1975 he served as a Project Engineer in the Flight Dynamics Group at NADC conducting analysis and manned flight simulation of aircraft controllability and flying qualities in specific flight regimes such as air-to-air combat and carrier landing approach. He published several papers in the *AIAA Journal of Aircraft* on these studies.

Mr. Eney has been an invited guest lecturer at Iowa State University, the Navy Top Gun Fighter Weapons School, the University of Alabama, the Naval Academy, and the U.S. Naval Test Pilot School. He has published approximately thirteen technical papers and reports on the subject of aircraft design and related technologies. He is also an FAA licensed Private Pilot, and an FAA licensed Airframe and Powerplant Mechanic.

Chairman MILLER. Thank you. And I know if you are not already comfortable enough, having been sworn twice, a legal oath and a religious oath, and asked if you had counsel present, and having reminded you the penalties of perjury apply, I also understand that our picture breaks up when you move too much, so if you could try to sit more or less still, which is something I had a hard time doing when my mother and my elementary school teachers told me to do it, but if you could try to keep your hand and your head relatively still, it would actually help us with our obviously still imperfect technology.

Dr. William Scheuren, is that—am I pronouncing your name correctly, Doctor?

Dr. SCHEUREN. Actually, it is pronounced, sir, Scheuren, like a scared bird.

Chairman MILLER. Scheuren.

Dr. SCHEUREN. And I am indeed one in these hallowed halls.

Chairman MILLER. All right. Thank you, Dr. Scheuren. Dr. Scheuren.

STATEMENT OF DR. WILLIAM J. SCHEUREN, FORMER DARPA DP–2 PROGRAM MANAGER AND FORMER HARRIER TEST PILOT; CONSULTING SYSTEMS RESEARCH ENGINEER

Dr. SCHEUREN. Thank you, Mr. Chairman and Members of the Committee. My background is an officer of the Marines. I am a Naval aviator, and I am an experimental test pilot, who tested many V/STOL vehicles over the years.

Mr. Hunter had a chart that showed the CH–46. I flew it operationally. I flew the prototype of the V–22, that is, the XV–15.

Chairman MILLER. Dr. Scheuren, if you could speak into the mike, please.

Dr. SCHEUREN. I am sorry, sir.

Chairman MILLER. And if you could also make a point of speaking into the mike, while keeping your head still.

Dr. SCHEUREN. I am sorry. I flew the XV–15, and I was involved in the early development of the V–22, and of course, as you noted in my bio, I was involved in the development and was the commanding officer of the first Harrier squadron.

I am very familiar with V/STOL. I first became acquainted with the duPont DP–2 aircraft in 1990, when I was asked to serve on a DARPA-inspired blue ribbon panel. I will give you an example of the members of the panel, there were many from NAVAIR Technologists, there were some from the Air Force. It included my test pilot colleague, Mr. Scott Crossfield, and speaking and writing a support on survivability, the esteemed Dr. Paul Kaminski, who later became the Under Secretary for, I don't know what the title was in those days, Research and Engineering or Acquisition. In any event, that panel concluded, and I won't try to go through and summarize its conclusions, but they were much the same as Mr. Eney elaborated on in his testimony.

In 1993, I joined the DARPA staff as a program manager, and my main program when I joined DARPA was the Common Affordable Lightweight Fighter, now the Joint Strike Fighter. However, I was assigned the task of being the program manager for the duPont DP–2 efforts, which had been funded by Congress and not requested in the DOD budget.

In 1996, we managed to team Mr. duPont and duPont Aerospace, with Lockheed and Pratt & Whitney, to try to take at least some aspects of the DP–2, and put them into a design that might be operationally useful to the special operations forces that Mr. duPont professed to want to serve.

We actually built a full-scale test rig of the cascade vector-thrust system, and put it in a test stand at Pratt & Whitney. On the high side of things, the vectored thrust system from the DP–2 did turn the thrust, and it did turn it satisfactorily from the standpoint of efficiency. Unfortunately, the design, which was produced by Mr. duPont, was filled with composites that wouldn't withstand the temperatures of the V5 commercial engine that we had attached to it, and so, Pratt & Whitney had to go to heroic efforts to cool the nozzle to keep it from burning up. We succeeded in that, but the nozzle design had also been judged by the industry experts, would be deficient in strength. When we got to full power, it came undone. It disintegrated.

Shortly thereafter, that ended that testing, and shortly thereafter, the program was transferred to ONR, and I lost touch with it, and I continued to do my other things at DARPA.

In conclusion, my summary of the capabilities of the DP–2 is that, like any concept that wants to fly, with today's technology, it could be made to fly. But at what cost, and what capability would it provide? Those are the real issues. Is the DP–2 the right answer for the soft mission? All the evidence I have seen says no, but then, it has been given a lot of money, but over 17 years, as Mr. Hunter pointed out, that is not much.

I agree if it is to go anywhere, I agree with my colleague that it needs to be tested not tied to the ground, and not with a pilot in it. Let us find out if it can fly if the Congress deems that it should.

Thank you, sir.

[The prepared statement of Dr. Scheuren follows:]

PREPARED STATEMENT OF WILLIAM J. SCHEUREN

SUMMARY

I am a former Officer of Marines, Naval Aviator, and Experimental Test Pilot. I retired from the Corps in 1982 and have since worked in various aerospace engineering capacities including eight years as a Program Manager for the Defense Advanced Research Projects Agency (DARPA). One of the numerous projects I managed at DARPA during the 1990's was the DP–2. The DARPA research efforts on the DP–2 were conducted under appropriations earmarked by the Congress specifically for duPont Aerospace and the earmarked appropriations were not requested in the Department of Defense budget requests.

DETAILED TESTIMONY

I was first exposed to the DP–2 in the 1990 timeframe when I was invited by DARPA to participate in a technical assessment of the DP–2 concept for a special operations forces V/STOL transport aircraft. At that time I was an employee of a small engineering firm and not a civil servant. The assessment team consisted of approximately six technologists with backgrounds in military aircraft design, flying qualities, performance, reliability, and safety—the evaluation areas assigned to the assessment team by DARPA. The team came to consensus that the DP–2 concept was fatally flawed in all of the stated evaluation areas with the possible exception of performance where we did not have enough details to make a confident assessment. Of particular concern were probable vertical/short takeoff and landing (V/STOL) flying qualities and the jet exhaust down-wash velocities with attendant erosion/debris production when attempting to operate from unprepared surfaces. Put more bluntly, we concluded that the DP–2 was very unlikely to be able to do the special operations forces mission it was purportedly designed to do.

In 1993 I was invited to join the DARPA staff where the focus of my initial program management efforts was the Common Affordable Lightweight Fighter—now the Joint Strike Fighter. At this time, and throughout the next three or four years we continued to receive unrequested appropriations for the DP–2.

My superiors at DARPA assigned me the DP–2 project and asked me to try to find a way to make the DP–2 design, or parts of it, useful to the military services. The DP–2 was supposed to be able to perform a clandestine special operations forces mission infiltration/exfiltration mission. DuPont took examples of SOF needs like transport range, mid-mission hover, and survivability, and combined them in a concept that he thought was a solution. The SOF representatives and we in the R&D community didn't agree with him.

In 1996 duPont teamed with Lockheed to jointly address the SOF mission needs. DuPont's role was to design and build a prototype cascade thrust vectoring system. The team, which also included Pratt & Whitney, built a full scale test article which was tested at the P&W West Palm Beach facility with some success. DuPont's vectoring system turned the gas turbine engine thrust with acceptable efficiency. Unfortunately, duPont's composite material curing process did not result in adequate temperature survivability and the structure lacked adequate strength. As a result, P&W had to take heroic engineering efforts to cool the vectoring nozzle and during a high power test the nozzle disintegrated thus ending the test—and ultimately the duPont/Lockheed/P&W DARPA-sponsored efforts.

The following year, or sometime during the latter 1990's the Office of Naval Research became interested in the DP–2 and asked DARPA to transfer the project to them. DARPA agreed and I am told DP–2 R&D efforts continue.

With enough time, money, and application of state-of-the-art aerospace technology we can make almost anything fly. The real issues are whether or not the ultimate product is worth the investment and whether on not the Nation is willing to devote the resources to achieve the capability.

BIOGRAPHY FOR WILLIAM J. SCHEUREN

Dr. Scheuren is a consulting aerospace R&D engineer having retired five years ago after serving eight years as an aerospace engineer at the Tactical Technology Office of the Defense Advanced Research Projects Agency (DARPA). Much of his current work is focused on collaborating with Dr. Leo Christodoulou of the DARPA Defense Sciences Office on DARPA materials and structures projects. As a PM at DARPA he was the program manager for DARPA involvement in the Joint Strike Fighter (JSF) program, the Unmanned Combat Air Vehicle (now J–UCAS) Program, the Active Noise and Vibration Reduction Technology Program, the Affordable Multi-Missile Manufacturing Program, and the T800 engine dual use program. At the JSF program office he was in charge of all JSF R&D activities directed toward aircraft Prognostics and Health Management (PHM) He personally conceived much of the JSF PHM architecture. During the past fourteen years he has conducted numerous systems engineering and analytic projects for DARPA, NASA, and the Services. He served 26 years in the Marine Corps where he gained extensive experience in research, development, testing, and acquisition of military weapon systems. He is a graduate of the Naval Engineering Test Pilot School and as a Military experimental and engineering test pilot he served as project director and pilot for numerous experimental and engineering test projects including: spin testing of the OV–10A aircraft, many of the AV–8A Harrier development projects in the UK and U.S., Navy preliminary evaluation of the Japanese PS–1 STOL seaplane, and STOVL stability and control research with the X–22 variable stability aircraft. His research and military operational piloting experience includes fighters, multi-engine transports, helicopters, seaplanes, gliders, and V/STOL aircraft. His operational career included serving as Commanding Officer of the first Marine Corps Harrier Squadron where he supervised operational test and evaluation of the Harrier. During this period, the squadron flew more than 10,000 flight hours with no loss of aircraft. He served numerous operational tours in fighter and attack squadrons including a Vietnam Combat Tour (150 combat missions). Having entered the service as a Naval Aviation Cadet, he became a commissioned officer and eventually achieved the rank of Colonel. Dr. Scheuren has a Ph.D. in Applied Research from the University of Virginia.

Chairman MILLER. Mr. Deadrick, it is my legal opinion that your testimony is subject to the legal penalties of perjury, but as to the theological question of whether you are free of any obligation under the Ten Commandments for bearing false witness, it is a topic about which I offer no opinion.

Mr. Deadrick.

STATEMENT OF MR. MARK DEADRICK, FORMER DUPONT AEROSPACE EMPLOYEE

Mr. DEADRICK. I just want to say that I have had very good experiences with Mr. duPont. I would still consider him to be my friend, had it not been for my departure from the company, but—and I agree with Mr. Hunter that I think there is value in this type of technology, but I will share my experiences with the company. If it helps make a decision on how to go forward, sorry for the movement there.

Good morning, distinguished Members of Congress and guests. My name is Mark Deadrick. I am a mechanical engineer, small business owner, and former employee of duPont Aerospace Company. I have joined the hearing today to describe my experiences while working at duPont Aerospace, including technical challenges and project management shortcomings.

Work history with the company. My initial contact with duPont was in November or December of 1988. While a third year engineering student at the University of California at San Diego, I replied to a job posting for a mechanical aerospace engineer. I had an interview with duPont President Tony duPont and former Vice President A.C. duPont, expressed my interest in model-making and radio-controlled aircraft. I was quickly offered a job as an intern/model maker. This model shop was located at Gillespie Field in El Cajon, it is currently one of the buildings that they still have in El Cajon. Along with A.C. duPont, I was involved with fabricating a full-scale wooden mockup of the proposed DP–2 aircraft. Later, in the summer of 1989, the facility was moved to Brown Field near the Mexican border. I think it was previously a Navy airbase.

Through the period of 1988 until I graduated from college, I predominantly worked on the DP–2 mockup, but from time to time worked on other projects, including demonstrator models for the National Aerospace Plane, and a 50 percent scale DP–2, to be referred to as a DP–1 wing spar. During the period from 1992 until October of 1994, I worked as a full-time employee after I had graduated.

In 1984, I decided to take a job in the automotive industry. I moved, took a job in metro Detroit, Michigan. My brother, actually, at the time or some time in 1996, had been employed as a fabricator at duPont Aerospace, and I was kept abreast of sort of things that were going on at the time, and I kept in contact with Tony over this time. And during the time, Tony had asked me twice to come back and work on both the full-size thrust vectoring that Dr. Scheuren just talked about, and then, to come back as an engineer on the current half scale demonstrator that we have seen the video of.

In January of 2002, I contacted Tony duPont to see if he could hire me back, and he agreed readily to hire me on the spot. I ended up starting at the end of February 2002, and was initially responsible for fabrication of the current, second-generation fuselage, which I think you saw in the test pictures.

The fuselage had been previously the responsibility of two engineers, who had left the company previously over the last couple of months or year, I am not sure when one of them left, but the other left soon after I started. The design had been completed, for the most part, so the next stage was to work on the actual fabrication of the prototype. Tooling had already been started, and it was being done at a remote facility that duPont was leasing from the Mississippi State University Raspett Flight Laboratory. I think it had previously been a Honda aircraft development facility. It was actually very nice. DuPont Aerospace had employed two technicians to repair the tooling and fabricate components, including the fuselage. They also did some work on empennage and wing components.

Over the following two years, I would travel to Mississippi at least four to six times per year, until the fuselage was completed, and then it was shipped back to San Diego. In 2003, I was named Manufacturing Engineering Manager, and was in charge of composite fabrication and aircraft assembly. Included in my duties were advanced surface CAD modeling of the full fuselage, inlet CAD modeling and shrouding, and then all composite tooling designs. I would also create operator lay-up manuals for composite fabrication, and work on advanced manufacturing processes, and organize incoming composite material destructive testing.

In June of 2005, I left the company. I had created my own product development company, 3dyn, focusing on composite design and manufacturing. I maintain this company today, with customers in aircraft, space, automotive, and consumer products.

In regards to the DP–2 program, many technical challenges have risen. As is well documented, vertical lift, fixed wing aircraft are likely the greatest challenge for aircraft designers. In no way is the problem a trivial one.

The features unique to the DP–2 are focused on the thrust vectoring system used for vertical or short takeoff. A full-sized test unit, which had been designed and built by the mid-1990s, and had been tested in the fall of 1996, and ended with a structural failure of the cascade sidewall attachment to the pitch control actuator. This attachment——

Chairman MILLER. Mr. Deadrick, I know you can't—-

Mr. DEADRICK.—keeps the cascade, or the structural——

Chairman MILLER. Mr. Deadrick, I know you can't see the lights from where you are——

Mr. DEADRICK. I am sorry.

Chairman MILLER.—but if you could begin to wrap up. Your entire written statement is in the record. If you could wrap up your oral statement.

Mr. DEADRICK. Okay.

Chairman MILLER. It would be helpful. Thank you.

Mr. DEADRICK. All right. We will skip through that.

With regard to the technical issues, some of the major pressures still exist in the thrust vectoring system. The main problems end up being the control system, material selection, fabrication techniques, and exhaust air temperatures.

Most of the structural failures have been in the thrust vectoring system. It is my opinion that the material that is selected for this system is, at least the composite material is not suitable for the temperature of the exhaust gas.

What is specified as an Advanced Composite Group, LTM110, which is a cyanate ester carbon fiber prepreg, listed in the company literature. It has a glass transition temperature of 572 degrees Fahrenheit, and it is my opinion that the temperature coming off the exhaust of the Pratt & Whitney 535A, at least from some documents we have seen of maintenance manuals, temperature is on the order of 700 to 800 degrees Fahrenheit, which is beyond the glass transition temperature of the LTM110.

Obviously, we will hear responses about some testing, where we actually have the major failure of the thrust vectoring system, where the cascade was let free, and crashed through the bottom of the fuselage, and test pilot Larry Walker was in the cockpit at the time.

Chairman MILLER. We are kind of running short. We were late when we started.

Mr. DEADRICK. Mr. Chairman.

Chairman MILLER. If you have one last sentence, perhaps, for us, Mr. Deadrick.

Mr. DEADRICK. Okay.

One last sentence, I would say that, I will just go to my conclusions.

I am of the opinion that this is a program that I think has technical merit to some degree. I think it has been mismanaged, and I think there are engineering issues. And I think company morale with the employees has been pretty poor, but I think it could be improved, but it will take a substantially larger budget than is currently offered.

I don't think $5 or $6 million a year could ever warrant a reasonable aircraft, even if it goes on for 20 years, because I think the continuity of employees is a problem. I think it basically either needs to be funded to a full amount to create an actual really working aircraft that is completely intact, as opposed to somewhat cobbled together, as I feel this one was. Otherwise, the program should just stop, because I think the way it is going now, there really was never going to be a flight-worthy aircraft that can be completed in the current process.

[The prepared statement of Mr. Deadrick follows:]

PREPARED STATEMENT OF MARK DEADRICK

Introduction:

Good Morning, distinguished Members of Congress and guests. My name is Mark Deadrick; I am a mechanical engineer, small business owner, and former employee of duPont Aerospace Co. Inc. (DPA). I have been asked to join this hearing today to describe my experiences while working at DPA, including technical challenges and project management shortcomings.

Work History:

My initial contact with DPA was in November or December of 1988. While a third year Engineering student at the University of California at San Diego, I replied to a job posting for a Mechanical/Aerospace Engineer. I had an interview with DPA President, Anthony A. "Tony" duPont and former Vice President Anthony C. "A.C." duPont and expressed my interest in model making and radio controlled aircraft. I was quickly offered a job as an intern/model maker. The model shop was located at Gillespie Field in El Cajon, California. Along with A.C. duPont, I was involved with fabricating a full scale wooden mockup of the proposed DP–2 Aircraft. Later, in the summer of 1989, the facility was moved to Brown Field near the Mexican border.

Through the period of 1988 until I graduated from college, I predominantly worked on the DP–2 mockup, but worked from time to time on other projects, including demonstrator models for the National Aerospace Plane (NASP), and a 50 percent scale DP–2 (DP–1) wing spar. During the period from January 1992 until October 1994, I worked as a full-time employee.

In October of 1994, I took a job in metro Detroit, Michigan to work as an engineer in the automotive industry. As my brother Tom Deadrick had been employed as a fabricator at DPA since 1996, I had occasional contact with the company and had visited at least once or twice. Tony had asked me twice in the preceding years to come back to work on both the full size thrust vectoring system, and the current half scale demonstrator.

In January of 2002, I contacted Tony duPont to see if he had an opening for me, and he agreed to hire me on the spot. I started at the end of February, and was initially responsible for the fabrication of the current, second-generation fuselage.

The fuselage had previously been the responsibility of at least two engineers who had left the company. The design had been completed for the most part, so I took the design into prototype, which would take place at a remote facility based out of Mississippi State University's Raspett Flight Laboratory. DPA had employed two technicians to prepare tooling and fabricate components, including the fuselage, empennage, and wing components.

Over the following two years, I would travel to Mississippi at least four to six times a year, until the prototype fuselage was completed.

In 2003 I was named Manufacturing Engineering Manager, and was in charge of composite fabrication, and aircraft assembly. Included in my duties were advanced surface CAD modeling of the engine inlets and shrouding, and all composite tooling designs. I would also create operator lay-up manuals for composite fabrication, work on advanced manufacturing processes, and organized incoming composite materials destructive testing.

In June of 2005, I left the company, as I had created my own product development company, 3dyn, focusing on composites design and manufacturing. I maintain this company today, with customers in aircraft, space, automotive, and consumer products.

Technical Issues:

In regards to the DP–2 program, many technical challenges have arisen. As is well documented, vertical lift, fixed wing aircraft are likely the greatest challenge for aircraft designers. In no way is the problem a trivial one.

The features unique to the DP–2 are focused on the thrust vectoring system, used for vertical or short takeoff. A full-scale test unit, which had been designed and built in the mid 1990s, had been tested in the Fall of 1996, and ended with a structural failure of the cascade sidewall attachment to the pitch control actuator. This attachment keeps the cascade, or the main structural member of the thrust vectoring system, from freely rotating. Without support, the system would become unstable, and may come into contact with the cabin floor, depending on the thrust level of the engine. I was not involved with the design, fabrication, or testing of this system, but I have seen the damaged components and recognized the potential failure mode.

With respect to technical issues that I have witnessed in design, fabrication, and test, the major problems still exist in the thrust vectoring system. The challenges particularly focus on the mechanical control system, materials selection and fabrication techniques, and exhaust air temperature.

Whether needed or not, the mechanical control system consists of numerous levers, bell cranks, bearings, push-pull rods and fasteners. Even with near zero manufacturing tolerances and infinitesimal flex (which were not met) excessive play in the system yields response critical hysteresis and free play. Nyquist and Bode plots from the bandwidth testing were conducted during the test program and should be available for review. Without a refined mechanical control system, both automated and pilot controlled hover will be very difficult.

Numerous structural failures have also hindered the program. Some airframe failures have been minor and can be addressed. Other failures, particularly in the thrust vectoring system and its integration with the airframe, have caused serious downstream damage, and have the potential for bodily harm.

Failures involved with the turning vanes, the composite, airfoil-shaped, lateral blades that direct exhaust thrust from horizontal to vertical downward, have been one of the Achilles heels of the program. In my view, buckling failures of the turning vanes, nearly always in the center of the exhaust cone, are the result of having been subjected to temperatures above the glass transition temperature of the material, or the level at which the resin will no longer support a reasonable load. The composite material used in the turning vanes, as well as the entire thrust vectoring system is LTM110, and cyanate ester/carbon fiber prepreg manufactured by the Advanced Composites Group (ACG). While sold as a high-temperature material, ACG product literature states that it has a maximum glass transition temperature 572 degrees Fahrenheit. It is also noted that the material is typically used for spacecraft interior equipment, radomes, and high temperature, non-structural engine parts.

Data published in the Pratt & Whitney 535A service manual state the temperature of the exhaust gas at approximately four feet behind the engine are on the order of 700 to 800 degrees Fahrenheit, beyond the glass transition temperature of the LTM110 material. I do not know if exhaust gas temperature readings were ever recorded as the testing engineers were not allowed to instrument the turning vanes with thermocouples during my time of employment. I believe this is a major issue that should be addressed if it has not been already.

Various structural failures have occurred over the course of the project, some minor, but at least one major, life risking failure. In November of 2004, a chained down test, in which the plane is not allowed to elevate, was conducted with test pilot Larry Walker in the cockpit and at the controls of the engine throttle levers. As I recall, Larry was testing either the engine acceleration response, or deflection of the thrust vectoring cascade, when a major structural failure occurred in the pivot attachment of the two cascades, in which a large piece of titanium was ripped free of its composite encapsulation, allowing the cascades to rotate beyond the horizontal stow position, crashing through the cabin floor, pushing the pilot's seat upward and forwards. I recall Larry Walker's helmet striking the ceiling of the fuselage. I remembered that just a day or two prior, Test Director Howard Northrup was sitting in the fuselage, measuring control movements, in the area where the cascades crashed through the floor. In my opinion, he would have been seriously injured or possibly killed if he was in this position during the failure.

An investigation into this failure lead to the determination that there was a failure in the adhesion of the carbon fiber to the titanium. I believe that once again, a material not suited for structural use was neither correctly specified, nor correctly processed. This area had been repaired numerous times due to delamination of the carbon fiber face sheets to the honeycomb core.

Management Issues:

The management structure at DPA is nearly vertical. Tony duPont is the President, his brother Rex duPont is Vice President, and Tony's wife Carol duPont (formerly the Vice President) is the Director of Administration. Only temporarily during my employment was there a Chief Engineer, who left shortly following the major failure of November 2004, after less than a year in that position.

Upon my re-hire in 2002, I believe there were 10–12 full time engineers on staff, but two left the company within the first two months. These positions were backfilled, but over the course of the next 2.5 years, the turnover had been such that I had been there longer than all but two other engineers. Most departures were to other aerospace companies in the area. I think there was close to two times turnover, with at least 15–20 Engineers leaving in the three years I was with the company. The engineering staff consisted of varying levels of experience, with a large portion of newly graduated engineers, who typically would work a year or two and move to a larger company. This situation would cause great discontinuity in the project, and ever decreasing familiarity with the total program.

Tony duPont's management style was very steadfast. He did not readily accept conflicting opinions. This does not mean he might not eventually accept them, but this caused much disillusionment among the engineering staff. The general rule of thumb was, Tony gets his way.

There was not a meaningful product development strategy or process. Engineers would typically work on individual projects, with little to no communication between them. Without a dedicated engineering manager, no one would take full development responsibility for the aircraft.

Ethical Issues:

Following the major failure of the thrust vectoring system, I found myself ready to be clear of any future such events. I did not feel that repairs to the system were being conducted in a proper manner. The materials selected for the thrust vectoring system would continue to fail, the process of fabrication was still limited due to insufficient equipment, and the fabrication personnel had limited experience.

As a new, lighter, fuselage would be introduced with the repairs, a change to the attachment of the wing would be conducted at the same time. During this time, there was a worldwide shortage of carbon fiber material. DPA had ordered, but not yet received material to make a thick attachment flange on the wing, but the delays would jeopardize the time get the plane back to test, with a ceremonial completion date of June 6, 2005 (it was now May 2005 and the plane was not close to completion). There was material in the storage freezers that had been quarantined due to suspect fiber quality. It was Tony duPont's directive, against my advice, to use this material to immediately begin fabrication of the wing mounting flange. With this decision, I concluded my professionalism was not respected, and I set plans to leave the company.

Tony and Carol duPont had been on vacation, and I was determined to leave the company before they returned. With poor discretion, I announced my intention to leave to a few other employees, and the word got to Tony while traveling. Tony called me on my cell phone, mentioned he heard I was leaving the company, and asked where I was going. Having already lined up a short term consulting gig, I told Tony I was going nowhere, that I felt the aircraft was unsafe, and I did not want to continue working for the company. His reaction was to tell me to immediately leave the company, collect my last paycheck and save the company any more damage. Tony then proclaimed that I was responsible for many Engineers leaving the company. I returned the compliment that he, and he alone was responsible for the engineering department's rapid decline. (As a note, during this time at least six engineers had quit over a six-month period, including the Chief Engineer.)

Conclusions:

As a parting statement, I feel that the DP–2 program has some technical merits, but a series of poor engineering judgments, mismanagement, engineering department morale, limited fabrication facilities and fabricator expertise all lead to a marred program. At the current fund level, it will be nearly impossible to achieve any meaningful results. I feel the program should be either funded to a useful amount, the plane developed from scratch, with a new management and engineering team, or the program should be canceled at once. At its current capacity, duPont Aerospace is not capable of developing a sound, safe, and flight worthy aircraft.

Thank you for giving me the time to express my observations and impressions of the program. I rest assured that a proper decision will be made as to the future of the DP–2.

DISCUSSION

Chairman MILLER. Thank you, Mr. Deadrick.

I will now recognize each Member of the Committee for five minutes of questions, beginning with myself.

THE OSPREY PROJECT

Dr. Scheuren, Mr. Hunter spoke about the Osprey. Were you involved in the Osprey project, and if so, what did you do?

I think you need to put on, your microphone may not be on. Or speak more directly into it. Could you sit in the chair marked for Mr. Deadrick, perhaps? Is that one working? And technology.

Dr. SCHEUREN. Oh, I got it now. And you will have to forgive me, Mr. Chairman. These things work, but not all that well. Your question was, was I involved in the Osprey program?

Chairman MILLER. Right.

Dr. SCHEUREN. And yes, I was, from square one. I flew the prototype, which was called the XP–15, and I was involved in conceiving the program at the Office of the Secretary of Defense.

Chairman MILLER. You heard Mr. Hunter compare the Osprey project with the DP–2. How would you compare the two projects?

Dr. SCHEUREN. That is a very difficult comparison. In one case, we started with a prototype that was flying, the XP–15. We knew the concept could work. The challenge was to create an operational vehicle. It cost a lot of money. We succeeded.

In the case of the DP–2, we have never managed to even get the "prototype" to hover. So, there is just not a comparison there, sir.

Chairman MILLER. Well, at the outset of each project, which appeared to have greater promise?

Dr. SCHEUREN. Oh, definitely the V–22.

Chairman MILLER. Yeah.

PROBLEMS WITH THE DP–2

Dr. SCHEUREN. The Osprey. Yeah, the DP–2, even if we could make it operational, it can't operate as designed from unprepared surfaces. The downwash velocity is just so great it would become an erosive mining device, and the debris would go everywhere, including back into the intakes, and I think they have had some experience with that already, even in the test rig.

Chairman MILLER. Mr. Eney, you heard Mr. Hunter's testimony. Do you have a response to what Mr. Hunter had to say?

Mr. ENEY. Mr. Chairman, with all due respect to Congressman Hunter, I believe he is speaking from a great deal of training from the contractor in this case, and from a total lack of engineering education and experience in general, and specifically, in the area of VTOL aircraft design and controllability of those aircraft.

Chairman MILLER. Mr. Eney, you have visited duPont Aerospace facilities in 1999 to assess how the DP–2 program was going, with a group with expertise in aeronautics.

Mr. ENEY. I am sorry.

Chairman MILLER. With a group of folks with expertise——

Mr. ENEY. Absolutely. Yes, yes. I had, accompanying me were 11 of the best experienced engineers from all of the disciplines within Naval Air Systems Command.

DP–2 PROGRAM MANAGEMENT

Chairman MILLER. Okay. What, if anything, about the visit to the DP–2 program gave you pause about the program itself, and how it was being managed?

Mr. ENEY. In short, everything, sir. Now, let me qualify that. These individuals had been used to being at large, well-established, well-funded aircraft companies. They have been known to visit small businesses for special projects that had already shown promise before they had any government funding. But I believe I can speak for every one of them that they were somewhat appalled at the austerity of the facilities and the amateur approach to the design and fabrication of the DP–2.

MORE ON DP–2 PROBLEMS

Chairman MILLER. Mr. Eney, I know that we have an artist's sketch somewhere, provided by duPont Aerospace, where—there it is, just behind you, actually. If you could look at the monitor. Oh, you can see it directly in front of you. Okay. Again, that is an artist's rendition of how the DP–2 would, the hope is how it would work. And it shows soldiers, or Marines, rappelling down a rope hanging from the back of the military version of the DP–2 aircraft.

From your knowledge of the DP–2 project, from your knowledge of engineering, what from a technical perspective, if anything, is wrong with that picture?

VECTORED THRUST PROBLEMS

Mr. ENEY. Primarily, there are two things. As Dr. Scheuren has already pointed out, a vectored thrust jet V/STOL, such as the Harrier, he called it a mining device over a soft field. If you have ever seen a Harrier attempt to land on a soccer field, or even in a park, as I have seen tapes of, the airplane goes into instrument conditions, because it literally rips the turf off the ground. If you superimpose that situation on a desert with rocks and sand, it will be worse. The engines will be destroyed.

The cartoons that we have seen this morning in the video, and this particular artist's rendering, imply that the jet thrust is a benign column coming straight down, creating no disturbance in the surrounding area. That is absolutely false, and also, this drawing illustrates the lack of appreciation in the duPont engineering of this concept, to the trimmability of this vehicle. The center of gravity of any VTOL airplane has to be over the center of lift. The center of lift in this picture is well forward. It is that yellow column depicting the exhaust thrust.

Now, you have got, in this picture, a squad of heavily equipment laden SEALs or Marines running the length of the fuselage, and hanging off the tailgate of the airplane. There is no way, with the current control system employed in the DP–2, that that airplane could even hold a level attitude, let alone hold it while those troops are hanging from the extreme aft end of the vehicle.

And by the time they got to the ground, they would be well fried by the exhaust gases, because the vehicle would have to point into the wind, and therefore, the heat from that exhaust gas would be much wider, and it would be going right into their rope. End of my comment.

Chairman MILLER. Okay. I do want to respect the time constraints, but in the interests of continuity of the question, Dr. Scheuren, you were nodding as Mr. Eney was speaking. From your experience as a test pilot, among other things, what if anything is wrong with the photograph, or not the photograph, but the artist's, the drawing?

Dr. SCHEUREN. I agree with Mr. Eney wholeheartedly. To begin with, the pilot wouldn't be able to control the airplane. It wouldn't matter if he could, because the mission would not be successful without live troops on the ground, and finally, the debris, to repeat it one more time, because it is ever so important, a machine like this has just got too much exhaust velocity to operate from other than prepared surfaces, meaning concrete, not even tar, concrete, or something even stronger than that, like steel matting, that is well tied down.

Chairman MILLER. Thank you. Mr. Hall.

WITNESS BACKGROUNDS AND OPINIONS

Mr. HALL. Thank you, Mr. Chairman. Dr. Scheuren and Mr. Eney, do either one of you know how old that photograph is that you are critiquing?

Mr. ENEY. I believe I have seen it over the past, at least 12 years.

Mr. HALL. And Dr. Scheuren, do you have any idea how old it is?

Dr. SCHEUREN. I am sorry, sir. I——

Mr. HALL. Do you have any idea how old—you have given us a lot of testimony about your critiquing of this picture. Do you have any idea how old it is?

Dr. SCHEUREN. No, I do not.

Mr. HALL. So, would it make any difference to you if it was as old as Mr. Eney has said it is? Would it change your opinion any?

Dr. SCHEUREN. No, sir.

Mr. HALL. What if I told you it is 30 years old? Would that? Or 20 years old? Would that change it any at all?

Dr. SCHEUREN. I suppose, sir, you are saying that it is no longer relevant, and that Mr. duPont is aware that this particular approach wouldn't work? That would certainly change my opinion, because it would imply that he has modified his machine to make it more adaptable to the mission at hand.

Mr. HALL. And if it is 30 years old, you would sure have a different opinion, wouldn't you?

Dr. SCHEUREN. Yes, sir.

Mr. HALL. Well, it is 30 years old, and older. And I am surprised that you don't know that. Who wrote your testimony for you today?

Dr. SCHEUREN. Mine, sir? I wrote it.

Mr. HALL. All right, sir. Then let me ask you some questions about it. Mr. Eney, you first reviewed the DP–2 in 1986. Yes or no?

Mr. ENEY. I personally did not. I was the new supervisor of part of the team that had just completed the review, and their review took place before I was in that position.

Mr. HALL. The oath you have taken, do you testify here today that you did not first review the DP–2 concept in 1986 at any time?

Mr. ENEY. My role was as their new supervisor.

Mr. HALL. I am not asking you what your role was. I am asking you what you did.

Mr. ENEY. I reviewed the report.

Mr. HALL. All right. You didn't review, then, the DP–2 concept.

Mr. ENEY. I reviewed it—I reviewed the evaluation of the team, part of which were my employees. I did not take part in the analytical evaluation of the vehicle myself.

Mr. HALL. All right.

Mr. ENEY. That had all been done by other engineers.

Mr. HALL. Who was your employer in 1986?

Mr. ENEY. The Naval Air Development Center in Warminster, Pennsylvania, under the Department of the Navy.

Mr. HALL. And you later led a team of senior Navy aerospace engineers in a site visit to the duPont Aerospace facilities in San Diego in 1999.

Mr. ENEY. That is correct, yes.

Mr. HALL. And who were you working for at that time?

Mr. ENEY. The NADC had been combined with the Naval Air Systems Command at Patuxent River, and in my position there, I was elevated to a GS–15. It became a Division, and my employer was official the Naval Air Systems Command of the Department of the Navy. The function was the same.

Mr. HALL. Dr. Scheuren, you were on the DARPA review team that provided an evaluation of the technical merits of the DP–2 concept in 1990.

Dr. SCHEUREN. Yes, sir. I was.

Mr. HALL. And later, you were the Program Manager in the mid-1990s, and former commanding officer of the first Marine Corps Harrier squadron.

Dr. SCHEUREN. That is correct, sir.

HARRIER ACCIDENT RECORD

Mr. HALL. All right, then. And I don't have any questions for Mr. Deadrick. He chose not to take the oath. Let me ask you, if you disagree with almost everything Duncan Hunter stated, do either one of you disagree with the fact that the Harrier, and Mr. Eney, you worked on it, do you disagree with the fact that prior to 1998, 45 Marines had died in 143 non-combat accidents, more than a third of the fleet had been lost to accidents? Do you agree? Do you have that knowledge?

Dr. SCHEUREN. I agree that those accidents occurred, sir, and I agree that the Harrier has, I guess, for want of a better term, a horrific accident record.

Mr. HALL. And you have that same opinion, do you not, Mr. Eney?

Mr. ENEY. Well, my only awareness of the accident record was through reading it, and periodicals such as *Aviation Week,* and in the safety reviews of the Navy.

Mr. HALL. I will agree that neither of you were witnesses to those crashes, but you both read of them, and you accept them, and you took them into consideration in your testimony.

V–22 ACCIDENT RECORD

Mr. ENEY. I did, yes.

Mr. HALL. And on the V–22 Osprey, that the second crash occurred in July of 1990, when seven people were killed. Do you remember reading that, both of you?

Mr. ENEY. I certainly do, since that happened very close to the city of Philadelphia, where—not the accident in Yuma, but the V–22 development was a major topic of the everyday news in the Philadelphia area while we were working at Warminster.

Mr. HALL. It was in the headlines. And you, sir.

Dr. SCHEUREN. And I, too, am very familiar with that.

Mr. HALL. And the crash of the prototype, June 11, 1991, three minutes into its maiden flight, you all are aware of that, are you not?

Mr. ENEY. I am, and if it is the accident I believe you were referring to, that was due to a mis-wiring of the flight control system.

Dr. SCHEUREN. And I don't know the details, but I am familiar with the accident.

Mr. HALL. On April the 8th of 2000, 19 Marines were killed when the V–22 crashed near Marana, Arizona.

Mr. ENEY. That, I only read about, and saw on the commercial news broadcasts.

Mr. HALL. All right. I will quickly go through these. If you disagree with any of this, tell me. On December the 11th of 2000, MV–22 crashed near Jacksonville, killing four people. March 2006, an inadvertent takeoff caused wing damage in excess of $1 million, and an engine fire in December 2007 caused more than $1 million in repair. The Marine Corps grounded all V–22s in February of 2007, as a result of a faulty flight control computer chip, after expenditure of billions of dollars, and not millions.

That is a correct statement, isn't it?

Mr. ENEY. Yes, sir. I can't argue with that. May I comment, sir, for clarification?

Mr. HALL. Well, I would rather you wouldn't, because my time is about up.

Mr. ENEY. Okay.

Mr. HALL. I have got what looks like a red light out there, but I thank the Chairman, with no backup here, and I am here alone, up against two of the most brilliant Members of Congress, that he is going to give me a little more time. I ask an additional five minutes. Could I have it? Two minutes?

Chairman MILLER. Two minutes will be just——

Mr. HALL. How about three?

Chairman MILLER. Well, we do need to get out of here by 12:30.

Mr. HALL. All right.

Chairman MILLER. And we have two more panels to go, and I did go over it a little bit. You have now gone over about as much as I did.

Mr. HALL. All right.

Chairman MILLER. So—but we might have time for another round of questions.

Mr. HALL. Can I finish with this question?

Chairman MILLER. You may.

CONGRESSIONAL FUNDING RESPONSIBILITIES

Mr. HALL. All right. And a great deal has been made about the fact that DOD has never requested funding for the DP–2, and that this somehow lessens its credibility. You all took that into consideration, didn't you? And DOD has never requested funding for the DP–2.

Mr. ENEY. That is my understanding, yes, sir.

Mr. HALL. And contrary to the belief that good ideas only come out of the Pentagon, Congress has been very successful at forcing the DOD to innovate and think out of the box.

For example, and for instance, it was the Congress, not the Pentagon, that pushed to arm the Predator and Hunter UAVs. It was Congress that pushed the up-armor Humvees, and it was the Congress that advocated for counter-rocket and mortar systems. Now, my question is this. Should Congress simply cede its Constitutional responsibility to raise and support armies and provide for a Navy, just because the Pentagon doesn't agree with them? Do you think Congress should just walk away and say the Pentagon is right? Let them do what they want to, we don't have any say over it. Is that your opinion?

Mr. ENEY. I would be happy to answer that, sir. My opinion is the role of Congress is to look out for the rights of the people and the country, and to protect the country, using the best means and the best data available to them. It is not their role to take a constituent's proposal, bless it as being gospel truth, and preaching it as if they were a salesman for that contractor.

Mr. HALL. Now that the Osprey is deploying operationally in the fall, should we now begin to look to follow-on technologies for the Osprey?

Mr. ENEY. I am sorry, could you repeat the question, sir?

Mr. HALL. Now that the Osprey is deploying operationally in the fall, should we now begin to look to follow-on technologies?

Mr. ENEY. Follow-on technologies, in the way of superseding——

Mr. HALL. Next generation.

Mr. ENEY. I believe that is always the case, sir. DOD is always looking down the road.

Mr. HALL. And you?

Dr. SCHEUREN. And I concur with that, too. I think we need to look into the future.

Mr. HALL. And with the knowledge that Congress acts on testimony of men and women who obviously know more than we do, we call them in just like you are here, and we pass or rule on things like that, and we are, we make decisions regarding what Congress has to do, and we won't cede our Constitutional responsibility, and you don't really think we should, do you, either one of you?

Mr. ENEY. I am sorry, sir. You lost me in the question.

Mr. HALL. Do you agree with Mr. Hunter, with former Chairman Hunter, that Congress has a duty, a Constitutional duty, to look out for the Army and Navy, and the men and women, as we see fit, from the testimony we take from men and women just like you that come before us, to make our decisions up here? Do you say Congress shouldn't be doing that?

Mr. ENEY. No, sir. Not at all. I think that that is your duty. However, as I said a moment ago, you need to use the best available data in reaching your conclusions and in taking your action.

Mr. HALL. Any of the data I read to you, that you agreed to, both of you, did you take that into consideration? I am sure you did.

Mr. ENEY. I am not here to say that the V–22 or any other VTOL project was without fault and was without difficulty. I just wish to point out key differences.

Mr. HALL. And Wilbur and Orville had those same problems, only in another day and time.

Mr. ENEY. And they didn't have any government contract either, sir.

Mr. HALL. That is right. They had one, their first government contract was a handwritten page and a half, and the Osprey, oh, that weighed about 20,000 pounds, so what have we got into.

Chairman MILLER. We are, we do have time constraints here. Mr. duPont needs to testify by video. I understand we lose our video window at noon, and we do want to be able to take this testimony.

Mr. Baird.

MORE ON VECTORED THRUST

Mr. BAIRD. Thank you, Mr. Chairman.

One of the things we cannot do here, we pass a lot of laws, but we can't repeal the laws of physics. And one of my questions to you gentlemen, it would seem to me, Newtonian mechanics, if we are going to lift a vehicle up into the air with a jet force coming down, the force of that jet engine must, in some way, generate enough velocity and enough energy to lift that vehicle straight up into the air. Is that a fair portrayal?

Mr. ENEY. Yes.

Mr. BAIRD. Now, my guess is, that it is that force that is driving this tunneling effect that you gentlemen have referred to, that tears up unprepared landing surfaces. Precisely the merit of this critter would be if it could land in the desert or on a mountaintop, or somewhere, without prepared field, right? It doesn't have as much merit if you can just land it on a runway. You got the runway.

Mr. ENEY. I agree with that, sir.

Mr. BAIRD. So, what is the difference? Educate us. There must be a difference between how the propeller-based helicopter system, or the propeller-based Osprey, lifts versus a jet force, in terms of the physics of it, because that is central to the question Mr. Hall is trying, I think, to refute, but educate us very briefly, I would like to have a one minute summary.

Mr. ENEY. Dr. Scheuren, may I take the lead on this?

The key term is here is disc loading. You have got to move a certain mass of air to overcome the weight of a certain mass in the vehicle. A helicopter is an example of an extremely light disc loading. That is, it spreads out the air that it is moving over a wide area, and it is at low velocity. You will still see large helicopters landing in the desert and going IFR in dust.

Mr. BAIRD. But the diameter of that sand——

Mr. ENEY. Yes. Yes.

Mr. BAIRD.—of the non-fixed wing is much greater than that of the thrust produced by a great engine.

Mr. ENEY. And the figure of merit that describes that mathematically is the disc loading.

Mr. BAIRD. Yeah.

Mr. ENEY. It is the weight being lifted over the area of the entire disc.

Mr. BAIRD. Could Congress, if a lobbyist asked us to pass a law repealing the impact of disc loading on aircraft function?

Mr. ENEY. My answer is no.

Mr. BAIRD. Even if it were in our best belief that it is in the best interests of the troops and the fighting capacity of our soldiers.

Mr. ENEY. I think the level of education in this country is high enough today so that no one would believe you if you took that position and passed such a law.

PRACTICAL PROBLEMS WITH THE V–22

Mr. BAIRD. All right. I am not so convinced that that is the case, gentlemen. I wish it were.

This business of people—I am sorry, it is climbing technology, rappelling out of the back of an aircraft, versus the balance. It seems to be, I have a little two year old, and I have the tallest baby of the world. I lift him up. He stands up, and it is wonderful fun until he leans forward. And then, daddy has got to catch him before we both fall to the ground.

So, I run these guys to the back, somewhere there is a fulcrum effect from the lift force of this jet engine, I am assuming. It works somewhat like a fulcrum.

Mr. ENEY. Yes, sir.

Mr. BAIRD. Because you are not using aerodynamics here, in terms of wing over aircraft, you are just balancing something on a force of air. So, it is kind of like a fulcrum. Guys run to the back, it tips up. What happens to keep that aircraft vertical under those circumstances? Or I mean not vertical, but flying.

Mr. ENEY. Yes, yes, I understand. You have hit the nail on the head, sir. A more practical vehicle is what we are using now, the CH–46. You have got a tandem helicopter that has two big forces at either end, and that is a big wrench on the vehicle, and it can deal with any problem.

The other extreme is the Harrier, or something like this vehicle, where you have got everything concentrated on one point, and if everything isn't all on the CG and staying there all the time, the vehicle attitude is going to change. And in the analysis done by the Navy in 1986, we computed that, and found that for even small deflections in the center of gravity of the vehicle, like one Marine moving from the middle to the tailgate, the vehicle would then have to take a new position, new attitude of 20 degrees nose down to balance itself and stay in position. That is the only way you can do it when you have got everything concentrated on that one jet thrust. And that is part of the breakdown in this concept.

Mr. BAIRD. If you were rappelling out of an aerial vehicle, which would you rather be subjected to, the exhaust from a jet engine, or the wind blast from a propeller?

Mr. ENEY. Me, with no military experience, sir, but a real wimp? I would deal with the helicopter before a jet blast.

Mr. BAIRD. I think I would, as well.

Dr. SCHEUREN. Sir, I have been under both, and there is not a comparison. It is definitely—you can deal with a helicopter. We do that operationally. We certainly don't put anybody under a Harrier. Crispy critter is the answer when you do that.

Mr. BAIRD. So, we have got a vehicle here that is designed to be able to extract Marines in difficult combat situations, but in so doing, fries whatever below it, and if people try to climb into it while it is suspended airborne, it tips off the critical balance of the vehicle, and thereby endangers its ability to fly. And on this, we are spending millions of dollars in the name of patriotism?

This doesn't sound right to me. It doesn't make sense. And I bet that if you ask—you know, we have got a can-do experience—I just watched the Space Shuttle fly last Friday. We have a can-do attitude in this country, and it is marvelous. It gets a lot of stuff done. But when that can-do attitude conflicts with basic laws of physics, then you have to be realistic, and I am afraid we are not being realistic. And you can gloss it up, or one witness behind you could gloss it up in the name of patriotism, or gee, the Pentagon just doesn't know what is right. There is a real difference here, and we can't repeal the laws of physics, and we shouldn't try to spend millions of dollars doing so, and I appreciate the gentlemen's testimony.

Chairman MILLER. Mr. Baird, in 1899, Indiana House Representatives did not like the idea of an unknown number, and they passed legislation to change pi to three, the number used to calculate the circumference of a circle. The Indiana Senate did not go along. If it had, we might have some experience on how well legislation does in changing the laws of physics.

Mr. Rohrabacher, we are under great time constraints, but if you, I know that you have had a great interest in this issue.

Mr. ROHRABACHER. Yes, I have.

Chairman MILLER. And you can have five minutes for questions.

DP–2 VERSUS THE HARRIER

Mr. ROHRABACHER. Thank you very much, Mr. Chairman.

First of all, let me note that a hunk of metal that weighs the same as an airplane, the laws of physics suggest that that hunk of metal will never get in the air and fly. That is the laws of physics. Now, you change that hunk of metal, change the hunk of metal so it is shaped like an airplane, then the laws of physics that apply to that hunk of metal change. For example, one of you just suggested that the aircraft has to, if one person in this aircraft changed the seating, that we then have to go down 20 percent, nose down 20 percent or something like that? Yeah. Well, let me ask you this, in the era of computers, do we have computers that actually do that for aircraft already? For example, it is not the fighter-bomber that we have, the stealth fighter, doesn't it have to make those same types of immediate, how do you say, changes in the way it is operating, in order to function? In an aero computer, that is no problem. You have an automatic change in the way the plane works in order to make it work.

Mr. ENEY. Sir, all of the computers in the world need to have a physical producer of forces with proper geometry.

Mr. ROHRABACHER. That is right.

Mr. ENEY. Your analogies are invalid, sir.

Mr. ROHRABACHER. I didn't hear—all I heard was a click. The thing about, you know, so what? You are trying to tell me you can't build the airplane that automatically adjusts with a computer system? I know you can. I know several examples of that. How about the Harrier jet right now? Right now, you would be telling us oh, my gosh, that just won't adjust. Think of what—well, I want you to know, Harrier jets operate, I know you have discussed this before, what is the bomb load of a Harrier jet?

Dr. SCHEUREN. Can I answer that, having flown it?

Mr. ROHRABACHER. What is the bomb load of a Harrier jet?

Dr. SCHEUREN. The difference, of course——

Mr. ROHRABACHER. No, no, no. What is the bomb load of a Harrier jet? That is what I am asking.

Dr. SCHEUREN. What is the——

Mr. ROHRABACHER. The bomb load of a Harrier jet. Payload.

Dr. SCHEUREN. The payload of it?

Mr. ROHRABACHER. Payload. Yeah, how many pounds.

Dr. SCHEUREN. I have flown it with more than 4,000 pounds.

Mr. ROHRABACHER. Okay. More than 4,000 pounds worth of payload in a Harrier jet. Is there some reason to assume that you can have a Harrier jet that can take off and land like that with 4,000 pounds worth of bombs, but you can't take, you can't build a similar type aircraft to take off and land carrying passengers?

Dr. SCHEUREN. The difference is the supporting thrust system. If you have a single post supporting——

Mr. ROHRABACHER. No, no, wait a minute. Hold on. I am not talking about this specific design. What we have here is a research and development model to try to see what exactly this post of air that people are talking about will do. Apparently, we spent $55 million on this research and development project. This is not a final completion. This is like the early stages of the Harrier, before we had computers, and people saying it can't work, and you know, and it did work. And we have 4,000 pounds of cargo in that carrier. I don't see the fundamental principle of trying to do that with carrying passengers; seems to me to be a very reasonable goal.

Let me ask you this. Have either one of you flown in combat?

Dr. SCHEUREN. Yes, I did.

Mr. ROHRABACHER. Okay. Have you flown a helicopter in combat?

Dr. SCHEUREN. No. I have flown——

Mr. ROHRABACHER. Okay. Let me note that I flew, in Vietnam, I was not in the military, but I happened to fly in combat zones in a helicopter. Now, you tell me which one would you rather be in, a helicopter flying over a combat zone to a potential drop area, going about how fast, under 200 miles an hour, probably 100 miles an hour or less, or would you rather fly in a plane, in a jet airplane, going hundreds of miles an hour? Which is safer?

Dr. SCHEUREN. Speed is life.

MILITARY NEEDS FOR THE DP–2

Mr. ROHRABACHER. That is exactly correct. So, how many people lost their lives in the V–22 project? 20. How many people lost their lives in this research and development project? Zero. All right. Okay. So, we have a situation here where we know that if we develop a craft that can go very fast over a combat area, that they are less likely to be shot down, we know that you can develop lift that goes up and down, carry large payloads, because we did it with the Harrier, why shouldn't we have a research and development project to see if we can develop an aircraft, to see if we can develop a design that will make that concept work?

Why shouldn't we do that? Okay. That is a good answer. I have followed this. I do not find this—I think that Tony duPont and the people may not have been the best managers of this project. Tony duPont is a renowned engineer. Sometimes, if you give engineers responsibility to manage, they are not the best managers. Sometimes, managers negate the best engineering, unfortunately. Tony duPont didn't lose any money on this. He has spent a very limited amount of money, one half of one percent of what went into the V–22, and we kept spending money on the V–22 when the hydraulic systems were killing 20 people, and no one could guarantee us that the hydraulic system would work.

Mr. Chairman, I find this inquiry to be very fascinating and interesting, but let us put things in perspective here, and not just try to find fault, you can take anything and find fault with it, but let us try to find the fault and balance it out with the positive potential benefits of something like this.

Thank you very much, Mr. Chairman.

Chairman MILLER. Thank you. And if we are to hear from Mr. duPont, we do need to end this panel. So, thank you all for appearing today. And Mr. Deadrick, thank you, as well.

Mr. DEADRICK. Thank you.

Chairman MILLER. Thank you. Our third panel has one witness, Mr. Anthony duPont, President of duPont Aerospace Company. Mr. duPont is suffering from a blood clot in his leg, and joins us via videoconference from a studio in San Diego.

Mr. duPont, as I know that you know already from having watched the hearing to this point, it is the practice of the Investigations and Oversight Committee to take testimony under oath. Do you have an objection to that?

Mr. DUPONT. No, sir.

Chairman MILLER. Okay. Do you have any preference of swearing before God, or simply taking an oath that has the same legal——

Mr. DUPONT. I will swear before God.

Chairman MILLER. All right. Mr. duPont, if you would raise your right hand.

[Witness sworn]

Chairman MILLER. Thank you, Mr. duPont. You also have the right to be represented by an attorney. Do you have an attorney with you today?

Mr. DUPONT. No.

Chairman MILLER. Mr. duPont, you now have five minutes for your oral testimony, your spoken testimony. Your written testimony has already been included in the record for the hearing. And when you complete your testimony, we will begin questions, with each Member having five minutes to ask questions.

Mr. duPont, you may begin.

Panel III:

TESTIMONY OF MR. ANTHONY A. DUPONT, PRESIDENT, DUPONT AEROSPACE COMPANY, INC.

Mr. DUPONT. Okay. The purpose of the DP–2 program is to introduce Vertical and Short Takeoff and Landing, V/STOL capability, into high performance, turbofan-powered fan aircraft using vectored thrust. The objective of the government investment in the program is to make a sufficient demonstration of the technology that the military services would be able to make an informed decision to use it. In other words, this is a research program, not a development program yet.

The DP–2 achieves vertical and short field operation by incorporating larger engines and vectored thrust attained with advanced carbon composite components, and I might add, a capability to trim over a wide range of CGs, which has just been discussed, into an otherwise conventional turbofan-powered transport aircraft.

In terms of currently operating aircraft, the DP–2 carries a larger payload about twice as fast and twice as far as the V–22, and is a lot less expensive.

The DP–2 was moved forward with private funding until 1995, when DARPA funded a full-scale thrust vectoring system test. Completed at Pratt & Whitney in 1996, this test resolved the issue of turning losses when the thrust vectors turn 90 degrees for liftoff. This is the major issue that was raised in the critical Navy review in 1986. As a result of the successful test, the remainder of the appropriated DP–2 funding was transferred to the Office of Naval Research, ONR, by DARPA, who wanted one of the services to continue the program.

The ONR program manager, Dr. Tom Taylor, wanted to build and fly a smaller airplane, because there were no 30,000 pound thrust turbofans available from the military, and no follow-on appropriation large enough to purchase them was on the horizon. A 53 percent DP–2 size was selected to use the available Pratt & Whitney Canada experimental 530A turbofans, and capitalize on some fuselage tooling available at Mississippi State University. Thus, the current DP–1 program was born.

In addition to the initial engine test vehicle, which had a steel wing, three version of the DP–1 have been built. All three versions demonstrated vertical liftoff. The last two had larger engines installed, and contained an autopilot system designed to accomplish autonomous tethered hover. Two Pratt & Whitney Canada 535A engines with considerably more thrust were purchased under a NASA grant in 2002.

Four incidents of equipment failure have been encountered during testing. The causes were analyzed, and fixes incorporated to prevent a recurrence. The latest version, the DP–1C, has almost airline type reliability for tethered hover testing, the only type of flight testing allowed by ONR.

The DP–1 can be flown repeatedly every hour, including being weighed and refueled between flights. Between July 19 and October 5, 2006, 49 flights were completed. Extensive analysis was conducted to validate the analytical model of the aircraft and the control system. The aircraft was trimmed and ready on June 1, 2007, and permission from the program manager to do hover tests was granted on Wednesday, June 6. The throttle servos have been moved down to the engines to eliminate the cable stiction, which is defined as static friction force to be overcome before the control moves, which is the reason the airplane could not acquire and hold altitude for extended hover during the 2006 tests.

Of the $71.4 million appropriated for the DP–2 by the Congress, $55.3 has been received by duPont for work on the DP–2. This figure includes both the NASA component and the DOD component, and the balance of the unexpended funds appropriated for Fiscal Year 2007.

Just a final thought. Runway independence is the critical need for future civil transport aircraft. A 3,000 foot takeoff and landing distance effectively gives runway independence. With 3,000 feet, almost all the smaller airports are available, as well as the unused portion of the inactive runways at the major airports. The DP–2 helps relieve airport congestion, both by handling traffic from smaller airports that will no longer need to use the nearest major airport, and by using the unused portions of the runways at the major airports.

The DP–2 can achieve 3,000 foot field length by using vectored thrust in a conventional takeoff and landing mode. Because its block speed is higher, and its hourly cost is similar, the DP–2 offers a 20 percent or more reduction in direct operating cost. Block speed advantage is not only the most fuel efficient cruising speed, Mach 0.88 versus 0.74, but also reduced time to climb, and less time on the ground due to being able to use shorter runways.

The DP–3 is the largest airplane that can be envisioned using the DP–2 technology. It is capable of carrying a Stryker vehicle. The limit is the engine thrust, and the GE–90 is currently the highest thrust engine available. Both the DP–3 and DP–2 have nearly identical performance in terms of speed and range.

Thank you.

[The prepared statement of Mr. duPont follows:]

PREPARED STATEMENT OF ANTHONY A. DUPONT

Program

The purpose of the DP–2 program is to introduce Vertical and Short Take Off and Landing (VSTOL) capability into high performance turbofan powered aircraft using vectored thrust. The program was moved forward entirely with company funds and outside investment until 1995. At that point previously appropriated funds were released by the Defense Advanced Research Projects Agency (DARPA) to fund a full scale test of the thrust vectoring system. The purpose of the government investment in the program is to make a sufficient demonstration of the technology that the military services would be able to make an informed decision to use it.

The DP–2 achieves vertical and short field operation by incorporating larger engines and vectored thrust into an otherwise conventional turbofan powered transport aircraft. The X–14, first flown in the 1950's, demonstrated the idea of fixed turbojet engines with a movable cascade system to achieve vertical take off and landing. One way to view the DP–2 program is to think of it as using the cumulative advances in aeronautical technology since the 1950's to provide an operational capability similar to conventional airline and military aircraft in a vertically rising aircraft similar to the X–14.

In terms of currently operating aircraft the DP–2 carries a larger payload about twice as fast and twice as far as the V–22, and is considerably less expensive to procure.

History

The origins of the DP–2 go back to the late 1960's when I was working for the Garrett Corporation and developing the Hypersonic Research Engine (HRE) for the X–15 and the ATF–3 turbofan designed to replace turbojets then in service on business aircraft. The HRE was managed by the National Aeronautics and Space Administration (NASA) Langley Research Center, and I spent a lot of time at that facility. NASA Langley was also testing two P–1127, early versions of the Harrier VSTOL fighter aircraft. I had ample opportunity to study this aircraft because both airplanes were often disassembled for maintenance and spread all over the hangar floor. My interest was in the potential market for the three spool high bypass turbofan technology embodied in the ATF–3. The high bypass and high overall pressure ratio promised a large increase in combat radius, and the mixed exhaust promised a huge reduction infrared signature as well as greatly reduced ground erosion. I talked with Jack Reeder, the chief test pilot, about flying the aircraft. He said that it was flyable without any stability augmentation. In fact most pilots preferred to turn off the stability augmentation system. However, he said he would like some artificial stability in height. It was easy to get pre-occupied and pick up a rate of descent in hover that was hard to stop with the thrust margin available. He also wanted altitude stability like a trimmed aircraft has in forward flight.

In the fall of 1968 Garrett was about to sign production contracts for the ATF–3 with North American Aviation and Dassault, but was unwilling or unable to buy the machine tools on which the cost and schedule were predicated. Not being willing to make promises I knew the company could not keep, I resigned from the Garrett Corporation. In the spring of 1969, I laid out an eight-place business jet with VSTOL capability.

The only small turbofan engines then available were the General Electric CF–700, an aft fan version of the well proven J–85 turbojet. This engine was in service on the Dassault Falcon 20 and was destined to eventually be replaced by the ATF–3. The reliability of turbofans was expected to be quite high. The odds of losing an engine on take off eventually passed a million to one making the odds of losing both engines on a twin engine airplane a trillion to one. Therefore, a twin engine VSTOL aircraft would be reliable enough to make commercial sense.

A number of locations for engine placement were studied, and side by side in the nose very quickly emerged as the only practical possibility. The engines had to be ahead of the airplane's center of gravity to permit vectoring the thrust downward for liftoff, and they had to be as close to the centerline as possible to enable the roll control system to maintain a level altitude if one engine fails.

The initial control system design was a bleed air "puffer jet" system like the Harrier. This proved to be unsatisfactory because not enough control moment could be generated with the available bleed air, and use of bleed air reduced the thrust lift available. A transport airplane has much higher inertia than a fighter and requires more moment to get the same angular acceleration response. A vane control system in the engine exhaust was designed to replace the bleed air system and remove these deficiencies.

While we were trying to arrange financing for this airplane, then called the DP–1, the bottom dropped out of the business aircraft market in the early 1970's. We had a larger airplane called the DP–2 using the General Electric TF–34, then in development by the Navy for the S–3A, on the drawing board when the Navy issued a request for proposal for VSTOL A, a utility airplane for the Sea Control Ship. No VSTOL A was procured, but the DP–2 got a little exposure. When the Navy issued a Request for Proposals (RFP) to replace the Grumman C–2A with an aircraft that could also be a 30 seat airliner, we were encouraged to respond.

Although the C–2A many years later was replaced by more C–2A's, the exposure to the Navy and the airlines generated enough interest to keep us working on the DP–2. A wind tunnel model with operating engines and a fixed thrust vectoring cascade that was removable for normal flight was tested in the eight-foot tunnel at Cal Tech in 1978. In 1982 the same model with a retractable cascade and vector control system was tested for a month in the 7 X 10 foot tunnel at NASA Ames. In the 1980's requirements in all the services as well as the Coast Guard and Customs Service were identified, but the numbers were too small to generate a Department of Defense (DOD) development program. In the late 1980's the Special Operations Forces became the most persistent advocate. Their interest was in an aircraft to meet their long range exfiltration requirement, notionally a thousand miles in and a thousand miles out at 200 feet above the ground with a vertical landing at the mid point. To make a vertical landing instead of a short landing larger engines were required.

The first engine that truly offered vertical capability was the Pratt and Whitney JT8D–219, which was rated at 21,700 pounds thrust. With this engine the DP–2 could insert and extract a twelve-man team weighting approximately 3,600 pounds. Later when funds appropriated for the DP–2 were finally released by DARPA in 1995, the International Aero Engines V2500 was selected in order to raise the payload capability to 10,500 pounds. This engine was used in a successful test of the DP–2 thrust vectoring system at Pratt and Whitney in 1996.

Following this successful test, which demonstrated a five percent thrust loss compared to the 25 percent estimated by a 1986 Navy evaluation sponsored by the Special Forces, the balance of the $15 million appropriation was transferred to the Office of Naval Research (ONR) by DARPA, who wanted one of the services to continue the program.

The ONR program manager, Dr. Tom Taylor, wanted to build and fly a smaller airplane because there were no 30,000 pound thrust turbofans available from the military, and no follow on appropriation large enough to purchase them was on the horizon. A 53 percent DP–2 size was selected to use available Pratt and Whitney Canada experimental 530A turbofans and capitalize on some fuselage tooling available at Mississippi State University. Thus the current DP–1 program was born.

In addition to the initial engine test vehicle, which had a steel wing, three versions of the DP–1 have been built. The DP–1A used leased PWC 530A engines rated at 2,887 pounds of thrust. The first lift off was achieved on January 16, 2002 with these engines, but in spite of many inlet refinements no additional installed thrust was obtainable. On October 9, 2002 two Pratt and Whitney Canada (PWC) 535A engines with considerably more thrust, over 4,000 pounds, were purchased under a NASA grant. The airplane, modified to install these engines, is called the DP–1B. The first liftoff of the DP–1B was on January 22, 2003. Many other successful liftoffs were accomplished in early 2003. In these flights the controls were locked. They were adjusted until the aircraft lifted off vertically. On May 10, 1999 Dr. Tom Taylor had sent a letter from ONR saying all hover testing would have to be accomplished autonomously without a pilot in the cockpit. This decision greatly increased the cost of the program and the time to complete. A rough estimate is a factor of at least three times the original manned flight approach. In the fall of 2003 this aircraft was flown several times under autonomous autopilot control. Testing was terminated after a dual autopilot failure on November 2, 2003 caused the airplane to hit the tethers at an excessive rate of climb. The subsequent gear impact, at a very high roll rate, pulled the main landing gears out of the wing.

The airplane was repaired with stronger landing gear attachments. Testing was resumed on April 14, 2004. During a control characterization test the nozzle box failed on November 16, 2004. The cause of the failure was testing a new NASA cascade vane design in the old nozzle box. The cascade pressed on the bottom of the nozzle box, breaking the tension link supports and eventually causing the cascade actuator to break loose allowing the cascades to rotate aft.

Rather than repair the DP–1B, a new fuselage was built with many other new parts to eliminate the control mounting flexibility that had emerged in the DP–1B as a result of the modifications to accept the 535A engines. New electrical wiring was installed to improve reliability, and a new, lighter tail built. The only major components retained from the DP–1B were the wing, the PWC 535A engines and the nozzle box. The floor of the nozzle box was modified to conform to the NASA cascade design and eliminate the cause of the November 2004 failure. This aircraft was renamed the DP–1C.

Testing of the DP–1C started on February 8, 2006. A nozzle box delamination failure released the cascade actuator on April 25, 2006. Rather than repair the nozzle box, the floors and tops were salvaged and incorporated into the new coreless configuration. In this nozzle box, the cascade actuator support is secured by a one inch diameter steel bolt precluding the previous failures.

Tests resumed on June 9, 2006. The airplane trim tests were completed, and the first tethered hover attempt was on July 19th. 49 flights were completed by October 5th, and by Navy direction operations were terminated on October 6th.

A greatly scaled down level of activity was resumed on December 13, 2006, again per Navy direction. Some testing in ground effect was accomplished in March of 2007. The test results indicated vortices shed by the nose wheel cause engine stall before the engines reach full thrust. Either engine could be run up to full thrust, but not both simultaneously. NASA laser sheet instrumentation was used during these tests, and the results indicate vortex ingestion as opposed to hot gas ingestion. NASA is supplying fast response pressure instrumentation to further investigate this phenomenon.

Extensive analysis was conducted to validate the analytical model of the aircraft and the control system. The aircraft was trimmed and ready for renewed hover attempts on June 1, 2007 and is waiting for permission from the program manager to do hover tests. The throttle servos have been moved down to the engines to eliminate the cable stiction, defined as static friction force to be overcome before the control moves, which is the reason the airplane could not acquire and hold altitude for extended hover during the 2006 tests.

DP–2 Program Viability

The DP–2 addresses the need for vertical operating aircraft with more speed and range than are available from rotary wing technology. A successful direct lift aircraft, the AV–8B Harrier, is in the Marine Corp inventory, and the F–35B, a successor to the Harrier, is in development. The DP–2 applies direct lift with a different type of control system to combine vertical and short field operation with the payload range capability of conventional airliners and combat transports.

Extensive use of composite structures and smaller wings and tails can provide an empty weight fraction similar to current turbofan aircraft even with larger engines. The DP–2 is compared to two similar sized conventional aircraft in the figure below.

COMMERCIAL COMPARISON

	DP-2	Gulfstream G550	Bombardier CRJ200 LR
Length	79 ft 8 in	96 ft 5 in	87 ft 10 in
Wingspan	58 ft 1 in	93 ft 6 in	69 ft 7 in
Height	27 ft 9 in	25 ft 10 in	20 ft 5 in
Weight (Empty)	30,037 lbs	48,300 lbs	30,900 lbs
Weight (Max Takeoff Gross)	53,000 lbs	91,000 lbs	53,000 lbs
Powerplant	2 x IAE V2500 Turbofans	2 x Rolls-Royce Tay BR710 Turbofans	2 x GE CF34-3B1 Turbofans
Thrust per Engine	33,000 lbs	15,385 lbs	8,729 lbs
Max Speed Best Fuel Economy Speed	.95 Mach .88 Mach	.89 Mach	.81 Mach .74 Mach
Max Range with Full Payload Max Range as Executive Jet	2,500 nm 4,000 nm	 6,750 nm	1,700 nm
Service Ceiling	45,000 ft	51,000 ft	41,000 ft
Field Length	3,000 ft T/O and Landing 500 ft VTOL	T/O 5,910 ft Landing 2,770 ft	T/O 6,290 ft Landing 4,850 ft
Crew	3	4	3
Commercial Passengers/Cargo Executive Jet Passengers	50 Pax or 10,500 lbs 12 Pax	 14-18 Pax	50 Pax or 13,100 lbs
Sales Price	$25M	$46M	$35M

One of these aircraft is a top of the line business aircraft and the other a widely used 50 seat airliner. Because its block speed is higher and its hourly cost is similar, the DP–2 offers 20 percent or more reduction in direct operating cost. Block speed advantage is not only cruising speed, Mach 0.88 versus 0.74, but also reduced time to climb and less time on the ground due to being able to use shorter runaways. Use of engines in widespread airline service provides similar hourly costs to the smaller engines installed in other aircraft, in spite of the larger engine size.

The military has two notional transportation requirements illustrated below. One is Ship To Objective Maneuver, STOM, which is to supply a beachhead 140 n. mi. inland from a ship 100 n. mi. offshore. How the acquisition cost of DP–2s to accomplish this mission compares to existing alternative aircraft is shown in the first figure.

SHIP TO OBJECTIVE MANUEVER (STOM)

Aircraft Type	CH47E	CH-53	V-22	DP-2	DP-3
Cruise Speed	143k	150k	240k	505k	505k
Time R/T 480 NM (Hours)	4.09	3.86	2.67	1.62	1.62
Payload (Tons)	4	5	2	9	36
R/T Per Day Capable	5.87	6.22	8.98	14.8	14.8
Aircraft Req. for 1,500 tons/day	64	48	84	11	3
Acquistion Cost	**$ 1.7B**	**$ 1.6B**	**$ 5.8B**	**$ 0.44B**	**$0.42B**

The other scenario is to deliver 2,000 tons per day from 2,000 n. mi. distance. The comparison of acquisition cost is shown in the table below. In both cases a larger aircraft, the DP–3 using GE–90 engines, is slightly more economical than the DP–2.

2000 TONS per DAY DELIVERED over 2,000 nautical miles

	DP-2	C-130J	DP-3	C-17A+
Cruise Speed	505k	340k	505k	442k
Time R/T (Hours)	7.3	11.9	7.3	9.6
Payload (Tons)	5.25	7.5	20.0	65
R/T Per Day Capable	3.3	2.0	3.3	2.5
Aircraft Req. for 2,000 tons/day	116	134	31	13
Acquistion Cost	**$ 4.7B**	**$ 11.4B**	**$ 4.4B**	**$4.9B**

* C-130J payload reduced to make radius

** Current C-17A uses 3,000 ft field, C-17A+ estimated cost of $378M per plane with 2,000 ft field length, cost does not include larger GFE engines

The DP–3 is the largest airplane that can be envisioned using DP–2 technology. It is capable of carrying a Stryker vehicle. The limit is the engine thrust, and the

GE–90 is currently the highest thrust engine available. Both the DP–3 and DP–2 have nearly identical performance in terms of speed and range.

Runway independence is the critical need for future transport aircraft. A 3,000 foot takeoff and landing distance effectively gives runway independence. With 3,000 feet almost all the smaller airports are available as well as the unused portions of the inactive runways at the major airports. The DP–2 helps relieve airport congestion both by handling traffic from smaller airports that will no longer need to use the nearest major airport and by using the unused portions of runways at the major airports.

A 3,000 feet field length can be achieved by vectored thrust in a conventional take off and landing mode. Enough thrust is available to achieve a 3,000 feet FAA take off distance without vectoring the thrust. If the landing approach is made with vectored thrust and 50 percent maximum thrust setting, the Federal Aviation Administration (FAA) landing distance is less than 3,000 feet. In the event of an engine failure on landing approach the good engine can be run up to 100 percent and the landing completed in the same distance as with both engines operating. This method of operation does not require the same precision control system needed for hover.

Critical Technical Reviews

At least four critical technical reviews have been conducted during the life of the DP–2 program. The first one was a Navy review funded by the Special Operations Forces in 1986. The basic numbers on aerodynamics and weights were in reasonable agreement with duPont's estimates, but a 25 percent thrust loss was estimated for the thrust vectoring system which affected the aircraft performance accordingly. This estimate was used in spite of data from NASA Ames testing showing a four percent loss. The full-scale thrust vectoring test in 1996, funded by DARPA, at Pratt and Whitney's Florida facility showed five percent loss. As a result of this test, DARPA released the balance of funds appropriated in 1991 and re-appropriated in 1993 to ONR to test an airplane using this thrust vectoring approach. Other concerns expressed about the thrust vectoring system have been resolved by the contracted DP–1 development work.

The second critical review was conducted by a blue ribbon panel of experts convened by DARPA in March of 1990. The information used by the reviewers was the 1986 Navy review, additional information on the review prepared by duPont subsequent to the 1986 review and submitted to the Navy and a briefing by duPont. The report included a roughly two page summary from each participant. All four of the findings were negative, supporting DARPA's decision not to spend the original $3 million DP–2 appropriation. The first was concern about exhaust erosion of unprepared surfaces. The second was control problems following an engine failure during vertical take off or landing. The third was critical of shutting down one engine to increase the range, and the fourth cited the difficulty of re-doing the aircraft to make it into a low radar cross section configuration. Most of the experts cited the difficulties to be overcome in a potential DOD development program. Almost all of these concerns have been overtaken by events as the full-scale thrust vectoring test and the DP–1 testing has moved forward. Scott Crossfield, then on the Science Committee staff, was one of the reviewers and was very supportive of moving ahead. Three Special Forces officers in attendance, who were strongly supportive of the DP–2 and the need for it, were ignored both at the meeting and in the written summaries.

The third critical review was a systems study by Dr. Mark Moore from NASA Langley in 2002 when NASA started funding the DP–2. His work, although generally sound, contained two errors which made the DP–2 have an excessive gross weight. The first was a very high fuel fraction for a 2,500 nautical mile stage length. He may have inadvertently used the fraction for 5,000 nautical miles. With the correct fuel fraction the DP–2 looks O.K. The second error was using vertical take off for a 5,000 nautical mile stage length. For 5,000 nautical miles the DP–2 uses a short conventional take off.

The fourth critical review was by the Naval Air Systems Command (NAVAIR) funded by John Kinzer, the ONR program manager for the DP–2. This report together with areas where duPont differs from NAVAIR's numbers is included in the final contract report for the contract terminated in 2006. Two copies of this report have been provided to the committee staff. To summarize the major points of contention: NAVAIR assessed a four percent bleed penalty at takeoff even though the airplane has no systems that use bleed air at takeoff, and some of NAVAIR's subsystem weights were very high compared to actual aircraft or weight trends. NAVAIR will not accept honeycomb core structure, but duPont has developed structure that does the same job without honeycomb. An example is the coreless nozzle box panels currently installed in the DP–1C airplane.

Testing Mishaps

Mishap is a word that implies something far more serious than the incidents that have occurred during DP–1 testing. In government terminology these are characterized as equipment failures.

The first incident occurred on November 2, 2003. The autopilot commanded full thrust, and the aircraft hit the tethers at a high upward velocity. The right wing tether came taut before the left causing a high rolling velocity, over 100 degrees per second. The right gear hit the deck first and then the left at a high velocity breaking the main gears out of the wing. The airplane came to rest on its belly damaging the nozzle box and thrust vectoring system. The airplane was repaired and was ready for test on April 14, 2004. A double failure in the autopilot system caused the maximum thrust command. The Differential Global Positioning System (DGPS) went into a less accurate measurement mode and said the aircraft was a foot below the starting position throughout the flight, and the rate feedback which would have caused a pull back in response to the high velocity was not working due to a hardware failure. Automatic shut downs were incorporated to prevent these and other failures from damaging the airplane in subsequent tests. When the gears were reinstalled they were strengthened as much as possible and the carbon composite blocks that support the gear trunnion bearings were redesigned to be more than twice as strong.

The second incident occurred on November 16, 2004. In this case the lower door was jammed against the nozzle box bottom breaking the upper tension link mounts, which in turn broke the keel allowing the titanium part which supports the cascade actuator and its carbon composite supports to rotate up into the floor and allow the cascades to move aft. The nozzle box was damaged beyond repair, and a second nozzle box was modified for future testing. The major modification was installation of new contoured nozzle box bottoms which allow the NASA designed cascade to move freely. The incident investigation was very prolonged and involved the same people who were designing a new coreless nozzle box that inherently precludes this type of failure. The new nozzle box design work had to be put off until the investigation was complete. This was the reason for re-working the second nozzle box instead of using the new design.

The third incident on April 25, 2006 involved a delamination of the solid carbon block that retained the titanium actuator support allowing the support to rotate upward and the cascade to move aft. The failure was a straightforward delamination that may have been caused by the jackhammer effect of rapid sinusoidal lateral control inputs used for control characterization testing, but the cause is not certain. The coreless nozzle box was far enough along that coreless sides and keel were mated to tops and bottoms salvaged from the damaged nozzle box. Testing was resumed on June 9, 2006.

The fourth incident was a test on August 8, 2006 in which the test was automatically aborted for exceeding the three feet altitude limit with an excessive rate of climb, in excess of two feet per second. The aircraft hit the left front tether first causing the airplane to land left wing down with a large left wing down rolling rate and side velocity component. The left gear impact caused a crack in a portion of the lower wing skin. The wing was repaired, and the aircraft was back on test on August 21, 2006. The cause of the incident was the installation of a loaner Inertial Navigation System (INS) unit that had a negative vertical velocity bias over 0.6 feet per second causing the autopilot to command more thrust than was required. To help preclude this type of failure the rate of climb limit for an automatic abort was reduced from two feet per second to one foot per second, and the INS biases were automatically measured just before lift off and the appropriate corrections inserted in the flight control computer.

Funding

Until 1995 the DP–2 program was funded entirely by the company's earnings and about $400,000 of outside investment. Since the DP–2 development became government funded, all but about $40,000 of all fees earned has been re-invested in the project. This investment totals about $5 million.

In addition to the $63.9 million appropriated for the DP–2 by the Congress, of which we received $47,991,844, NASA has awarded grants to duPont Aerospace in the amount of $7,500,000 to further support the DP–2 project. DuPont has received $7,326,547 of this grant money and has applied it to the purchase of two Pratt and Whitney 535 engines, development of the NASA designed cascade vane and additional research as mutually deemed beneficial by NASA and duPont Aerospace.

Progress to date

At the present time the DP–1 research and demonstration aircraft has been developed to the point where it has almost airline type reliability for hover testing. The DP–1 can be flown repeatedly every hour including being weighed and refueled between flights.

The DP–1C has a slightly lower structural weight fraction, defined as wings, fuselage, tail and landing gear divided by gross weight, than the KC–135 which has the smallest fraction of any transport aircraft, civil or military.

The surface controls that move the elevators, ailerons and rudder have not yet been installed and connected to the stick and rudder pedals. The parts have been made, and a duplicate set has been installed on the iron bird, a test framework, for check out prior to installation in the aircraft. This work is proceeding, but at a slower pace because, by Navy direction, it has a lower priority than tethered hover or in ground effect testing.

The iron bird also is used as a flight simulator, and both the DP–1 and DP–2 can be flown throughout the flight envelope. In 2006 a series of tests were flown to see if further wind tunnel testing was required for flight safety. The results showed that any stability derivative could be varied plus or minus 50 percent, and the aircraft could still be flown safely. The expected error in any of these derivatives is much less than 50 percent.

The analytical model of the aircraft, vector control system and autopilot servos has been exhaustively reviewed by the NASA Airworthiness Review Panel (ARP). The model agrees closely with the flight data obtained to date. With the recently measured reduced stiction in the throttle system this model predicts hovering flights of indefinite duration within the box defined by the tether system, six feet wide, six feet long and three feet high. With the stiction measured in 2006, the model predicts a tendency to climb out of the box as observed in all but one of the 2006 tests that got more than a few inches off the deck. To put the tethered hover task in perspective, the specification ADS–33E for the most maneuverable classes of helicopters is to hover in a six foot wide, six foot long and four foot high box for 30 seconds starting from a trimmed hover. The DP–1 has to acquire the desired altitude and trim itself with a foot less altitude to maneuver in.

BIOGRAPHY FOR ANTHONY A. DUPONT

Mr. Anthony A. duPont brings to duPont Aerospace Company and to the DP–2 project 40 years of successful experience in aviation design and development. His career started as a pilot for Pan American World Airways. He joined Douglas Aircraft at the beginning of the manned space flight program, where his first major assignment was the design of the Saturn Rocket upper stage to man-carrying standards. Later, as Chief of Aerospace Advanced Design in the Aircraft Division, he was responsible for Douglas' aerospace plane program and the design of high speed commercial transport aircraft.

Mr. duPont became Director of Product Planning of the Garrett Corporation in 1963. In this capability he was responsible for assuring that Garrett's line of aircraft systems were responsive to the aircraft industry's needs, and he planned the company's successful diversification program into jet engines and commercial products. As Manager of Advanced Propulsion Engines he managed the initial jet engine activity, from which has developed an annual business of roughly $500 million. He was responsible for the development of the NASA Hypersonic Research Engine and the ATF–3 turbofan engine for business and Coast Guard surveillance aircraft.

Mr. duPont founded the duPont Aerospace Company, Inc., in 1969 to pursue the development of deflected thrust applied to corporate, military, and airline aircraft. In the early 1970s, duPont Aerospace performed under NASA contracts on the injector ramjet and an aspect of the Space Shuttle. More recently the company has developed the Government Baseline Design for the National Aerospace Plane program, and accomplished the aircraft engineering for quiet nacelles for the DC–8 aircraft which meet current FAA noise standards. The expenses of corporate development have been underwritten by Mr. duPont's earnings as a business and energy consultant for firms such as Teledyne, Booz, Allen and Hamilton, Airco Cryogenics, R. Dixon Speas, MTI, and Pacific Lighting. His assignments have been diverse and have included serving as Chief Engineer at Rotoflow, the world's leading manufacturer of radial turbine and compressor installations used by gas processing industries. Mr. duPont has eight issued patents including the design of the ATF 3 aircraft engine, which was produced for the Falcon 200, and the design of the DP–2.

DISCUSSION

Chairman MILLER. Thank you, Mr. duPont. I will now recognize myself for five minutes of questioning.

DP–2 FUNDING

Mr. duPont, I know that you testified before the Science Committee in 2001, in a hearing about this project. Has the Armed Services Committee ever had a hearing on the DP–2 project?

Mr. DUPONT. No.

Chairman MILLER. Okay. In your testimony before, again, the Science Committee in 2001, you said that you had spoken with Boeing, Lockheed, and Grumman, and other aerospace companies about investing in the project, in the DP–2, and that none of them were willing to invest. Is that correct?

Mr. DUPONT. No, it is not.

Chairman MILLER. Okay.

Mr. DUPONT. I had talked to those companies about machining parts of the airplane, when it was still an aluminum airplane design, and we weren't so much interested in them investing in the project as participating in it, and we would get outside investment, and customer progress payments to pay for the construction of the airplane.

Chairman MILLER. Were they—did you ask them about investing in the concept, developing the concept of the DP–2 or the vectored thrust?

Mr. DUPONT. No.

Chairman MILLER. Okay. You said that until 1995, you had private funding. What was the source of the private funding?

Mr. DUPONT. The private funding was whatever we could earn from other activities, and a little bit of outside investment.

Chairman MILLER. There has been $63 million of taxpayer investment. How much was the private funding?

Mr. DUPONT. Approximately $5 million.

WHY FUND THE DP–2?

Chairman MILLER. Mr. duPont, I have got many prepared questions that are very harsh and accusatory, and I have no interest in asking those. I really do admire your faith in this project, but my question is much the same as what I asked of Mr. Hunter.

We in Congress are not experts in this field, nor are we experts in many of the fields that we must make judgments about. And we must rely upon the expertise and judgments of people who really do it for a living; they devote their lives to becoming experts in certain areas. In this case, it appears that all of the people that you would expect Congress to rely upon believe that this concept is deeply flawed, DARPA, NASA. How do we make our own judgment contrary to that of DARPA and NASA, to proceed with funding a project that has yet to work?

Mr. DUPONT. I will give you a couple examples, sir. The first one was that group that Mr. Eney talked about, said that the thrust losses were going to be 25 percent going through the cascade system. When the test results were in from the Pratt & Whitney test in 1996, the exhaust losses were five percent. Now, that 25 percent estimate was in spite of data that we had attained in a joint program with NASA Ames, where the losses were measured at four percent on a small wind-tunnel model.

So, I think, sir, you have to look at the facts. I am sure these guys were sincere, and they did careful analysis and all that, but their conclusion was wrong.

And the other discussion, another example is this prolonged discussion about being able to trim the airplane while people fast rope out the back of it and the environment when they hit the ground. This vertical thrust vectoring system is unique, in the sense that you can move the cascade and the control box in a way that you can keep the airplane level beyond the normal aerodynamic CG limits. So, you can trim the airplane level while people are moving to the back and going down the rope.

And a few years ago, we had a demonstration of fast roping, using the elevated test stand, and the environment is still where people are coming down on the fast rope, when they hit the ground, there is a flow, it is about knee high, that is about 40 knots and 130 degrees Fahrenheit. So, I say it is like wading in a trout stream. It is not this harsh crispy critter thing that Bill Scheuren is talking about, and that is because this engine has a mixed exhaust, and the average temperature is 400 degrees Fahrenheit, whereas the rear jets of the Harrier are like 1,300 Fahrenheit.

So, I think it is just, as time has gone by, and more evidence has become available, I think these same experts would probably reach different conclusions.

Chairman MILLER. I have more questions, but in the interests of time, Mr. Rohrabacher.

VALUE OF VECTORED THRUST

Mr. ROHRABACHER. Thank you very much.

So, Tony, what we have here, basically, is a research project, which people are trying to evaluate as if it is the purchase of a weapons system. Let us make that really clear. We spend a lot of money on research projects to find out basic truths that let us understand that the laws of physics are not being violated here, because we have now looked at some basic ideas.

Do you think that, now that you have had your experience, do you think that a research project into vectored thrust, which is what this really is all about, do you think that that is still a viable concept?

Mr. DUPONT. Well, I think that——

Mr. ROHRABACHER. Let me put it this way. Is the DP–2 going to fly? Is it going to go up and actually do this, or is this a failure so far, in terms of developing technology?

Mr. DUPONT. No, it is ready to fly almost right now. We are restricted from piloted operation by the Navy rules. We don't have enough money to have two or three spare airplanes, which is what would be required for——

Mr. ROHRABACHER. Okay.

Mr. DUPONT.—an unmanned flight test program. The history of almost every unmanned program is they have lost at least one airplane.

Mr. ROHRABACHER. All right.

Mr. DUPONT. And so we are——

Mr. ROHRABACHER. Well, we know that the V–22, Tony, that they lost more than one craft, and that we lost over 20 lives in the V–22 research project, which I might add, spent roughly, your research project has roughly one, less than one half of one percent of the research that went into the V–22 has gone into trying to look at the vectored thrust concept that you have here.

Let me note that I followed this project all along, and by the way, again, let me state for the record, I have no problems with defending this as a viable research project, to see if vectored thrust was, indeed, viable as a way of having vertical landing and vertical takeoff. But let us note this, Tony. Your sale of this project wasn't just based on hovering. It was also based on short takeoffs and landings, as well. Is that correct? Because that was the commercial potential. That is where you had a lot of commercial potential.

Mr. DUPONT. Yeah, that is exactly right. The commercial potential can be almost 100 percent reached without ever hovering. And the proper way, the most expeditious way to demonstrate this technology, and get the bugs out of it, is to take off as a conventional airplane, go up to a safe altitude, where you can recover the airplane no matter what goes wrong with it, and slow down a little bit using vectored thrust, then come in and land at that speed, and take off at that speed for the next flight, slow down a little bit.

VERTICAL TAKE OFF AND LANDING

Mr. ROHRABACHER. Okay. Well, Tony, for the record, I have only got a few minutes here, that is why I am cutting you off. For the record, when this program was being described to those who supported it, including myself and Duncan Hunter, the military concept of the plane, which was to take off and land on aircraft carriers, which was essentially what it was being proposed for, was one of the two major promotional angles that you had, in terms of defending this as a research project. The other was short takeoffs and short landings that would revolutionize America's small airports, and permit us to have a change in aviation in the United States of America. I think that was worth some research and development dollars.

Tony, during this time period, there was a problem with the hydraulic system in the V–22. Was there any other project that you know of, beside your own, that was then looking into vertical landing and takeoff? Was there anything else other than you and the V–22?

Mr. DUPONT. This is the only one I know about.

Mr. ROHRABACHER. It is the only one I know about, and perhaps, at a time when the V–22, when we were told that there was no way to fix the hydraulic system in the V–22, perhaps it was a good idea, maybe, to do some direct research into vectored thrust? I mean, that sounds like a good fundamental research concept to me, to see if it will possibly work.

Again, I want to commend the Chairman here, because we have noted that it is very easy to be accusatory, and I think that this was very well-deserved here. People need to be able to ask you questions, and to kibitz with experts, to find out whether or not projects like this are worthy of the research grants that Congress provides, and I will note that there are research grants provided not just in the Defense Department, but NASA and everywhere, that are earmarked, and have been earmarked for decades. This is one of them. I have no problem in saying that this was, at that time, very worthy of a research grant to see if vectored thrust could actually succeed, and that we could have short takeoff and landings, as well as perhaps vertical takeoff and hover.

So, thank you very much, Tony, and I have used up my time.

CURRENT STATE OF THE DP–2

Chairman MILLER. Mr. Baird.

Mr. BAIRD. Thank you, Mr. Chairman, and I thank the witness. Just for the record, I would like to requote former Chairman Hunter's remarks about the vertical takeoff capacity. He writes, in his own testimony: "In short, we need an aircraft that could land and take off vertically like a helicopter, but fly with the speed of a jet, with capacity of transport." At least according to Mr. Hunter, it does not look like the prime envisioning of this aircraft was just short takeoff and landing. He wanted a vertical craft.

Mr. duPont, all the witnesses took an oath to tell the whole truth, and Mr. Hall added the words so help me God, I believe. In your testimony, you write the following: "In terms of currently operating aircraft, the DP–2 carries a larger payload about twice as fast and twice as far as the V–22, and is considerably less expensive to procure. Is that the truth?

Mr. DUPONT. Yes.

Mr. BAIRD. We have an aircraft today that has demonstrated the capacity to carry a larger payload twice as fast, and we know from experiential evidence that it is considerably less expensive to procure. I mean, could I get in this thing? I can get in, I may not want to get in an Osprey, but I could. Could I get in, you write in such a way, and I am not trying to just parse language here, you write in a way that sounds like we have proven this concept, and have a vehicle available.

Mr. DUPONT. I think we have proven the elements of the concept. Of course, we don't have a production airplane, but we didn't have $11 billion either.

Mr. BAIRD. So, there is not actually a currently operating aircraft, that has demonstrated the ability to fly twice as fast.

Mr. DUPONT. No, that depends on wind tunnel data and all that kind of stuff, that actually, in the original Navy thing, that Mr. Eney talked about, they pretty well agreed with our aerodynamics and our weights, and they are——

Mr. BAIRD. Well, let me ask this.

Mr. DUPONT.—thrust vectoring system.

Mr. BAIRD. This city has had some unfortunate experience with an individual parsing the meaning of the word is. If we were to write, and is considerably less expensive to procure, what is the meaning of is in this sentence?

Mr. DUPONT. The meaning of is, is its projected cost is a lot less than a V–22.

Mr. BAIRD. So, the whole truth would be whose projected cost is, not that is considerably less expensive.

Mr. DUPONT. Yes. You are correct, sir.

DP–2 THRUST PROBLEMS

Mr. BAIRD. You heard Mr. duPont's testimony about the issue of this, I inquired about this tunneling effect of a jet engine pointed straight down. When I was a kid, I used to build rockets, and boy, if you could hold one of those things on the ground, you would blow a hell of a hole in the dirt with just an Estes rocket, and it wasn't trying to lift a cargo load with a bunch of people. What about that issue?

How do you solve that? I mean, we are talking an aircraft filled with Marines and equipment and all of that. How do you solve that issue, that the Harrier, apparently, as our experienced test pilot and actual command pilot, has asserted? If it is flying, hovering vertically over an unprepared field, it burrows a hole, and flies a bunch of junk into the air, and sucks it back into the intake, and ruins the jets, so you can't take back off. How do you solve that with this craft?

Mr. DUPONT. I don't know what credibility you want to put on this, but DARPA published a curve, in connection with that 1990 or some earlier review, that said that with the mixed exhaust that the DP–2 engine has, the airplane can hover over sod and asphalt.

Mr. BAIRD. With what consequences?

Mr. DUPONT. None.

Mr. BAIRD. Really? Because it just seems to me the key element.

Mr. DUPONT. The difference is the mixed exhaust temperature of 400 degrees is, and of course, it mixes with the outside air, and is cooler now when it hits the ground, it doesn't like vaporize the sod, like——

Mr. BAIRD. No, I think it is just a question of force. I mean, for every action, there is an equal and opposite reaction. What is this craft projected to weigh fully loaded?

Mr. DUPONT. It is, fully loaded and hovering, maybe a little over 50,000 pounds.

Mr. BAIRD. So, somewhere, you have got to—and what is the radius of the exhaust thrust projecting down into the ground? Well, the radius times three, versus——

Mr. DUPONT. Well, let us say it is a rectangle 180 inches by 40 inches.

Mr. BAIRD. Well, 100 inches by 40 inches, I could do that here, and how much pounds does that rectangle have to lift up? You just said and I forgot. I am sorry.

Mr. DUPONT. 50,000, over 50,000 pounds.

Mr. BAIRD. So, I am going to lift 50,000 pounds with a rectangle about the size of my desk here, 100 inches by 40 inches, and that is not going to cause some burrowing effect, regardless of the temperature?

Mr. DUPONT. No, the wind effect is much less important than the temperature effect.

Mr. BAIRD. But you have still got to lift. I mean, let me ask it this way. Would you put a 50,000 pound object, stationary object, let alone a forced object, stationary object, on a square block of 40 inches by 100 inches, on a dirt or sand field, and expect it to not fairly significantly impact that field? It seems like a lot of weight.

Mr. DUPONT. It is going to have considerable pressure, but so does your foot.

Mr. BAIRD. Well, actually, I think it is an apt analogy. My foot is about 12 inches long by about four inches wide, and it holds 200 pounds, so that is roughly 12 square inches. Yours is about 4,000 square inches to hold 50,000 pounds. I just question this burrowing thing, and I think you would have to really look into that. Again, if it is a short takeoff and landing, that may be another thing, and that may well be worth looking at, but I think the whole truth, if Mr. Hunter is arguing, on one hand, in his testimony, that we need a vertical takeoff landing thing, like a helicopter, that powers by jets, the whole truth is that has significant problems with it, as I think our experts have suggested, and that may be why some other aircraft manufacturers have not advocated for it.

I thank the gentleman for his time, and I admire, and I am a great fan of space exploration, and air flight, and admire people with new ideas, but not all of them work, and at some point, you just have to say the physics doesn't pencil out, and therefore, we shouldn't pump the money in.

Mr. ROHRABACHER. Would the gentleman yield for a question?

Mr. BAIRD. Sure, because I have no time left.

Mr. ROHRABACHER. Would you be supportive of research into areas that are not a for-sure payoff, and going to for-sure come out with a result? Are things like vectoring thrust worthy of research?

Mr. BAIRD. Of course it is worthy of research, but I think the fundamental question is if mathematically, I can say that this amount of thrust is generating this amount of force, in order to sustain this weight at this velocity, it is going to have some consequences over X, Y, or Z surface.

Mr. ROHRABACHER. Is it worth researching that?

Mr. BAIRD. It is worth researching, but it is not worth——

Mr. ROHRABACHER. Okay. That is——

Mr. BAIRD.—misrepresenting the capability, and it is not worth selling the taxpayer on something that it can't perform.

Chairman MILLER. We are about to lose our window for this video. Again, Mr. duPont, thank you very much for appearing, and we do have one more panel. We do need to be out of this room. Well, there is another, this room has other uses at 1:00, and we need to be out before that.

So, thank you, Mr. duPont, very much.

And if the next panel could take, we have one more panel, if they could take their seats.

Thank you. Our fourth panel represents various federal agencies that have been involved with the DP–2. Our first witness in this panel, Mr. John Kinzer, is the current DP–2 program manager and Deputy Director of the Air Warfare and Naval Weapons Division of the Office of Naval Research. He is a graduate of the U.S. Navy Flight Weapons School and a retired Navy Captain. He has flown more than 35 different types of aircraft.

Second is Lieutenant Colonel Michael Tremper. Col. Tremper is a pilot for Delta Airlines, and has been the Defense Contract Management Agency's government flight representative, providing operational oversight of the DP–2 program since 1999.

Colonel Warren Hall is the Assistant Director for Aviation and chief test pilot at NASA's Ames Research Center. He is also Chairman of the Office of Naval Research's DP–2 Airworthiness Review Panel. He has authored 73 technical reports and flown more than 65 different aircraft.

Ms. Marie Greening is Executive Director, Aeronautical Systems Division, Defense Contract Management Agency. She is accompanying Lieutenant Colonel Tremper, and will make some brief remarks.

Gentlemen and Ms. Greening, again, you know that we take oaths. Do any of you have any objection to taking an oath? All right. Do any of you have any strong preference on what kind of oath you will take?

Will you take the standard oath? If you would please raise your right hand.

[Witnesses sworn]

Chairman MILLER. Thank you.

You also have the right to be represented by an attorney. Do any of you have an attorney with you? All right. You will each have five minutes. Your written testimony will be included in the record. You will have five minutes for oral testimony, and when all of you have completed your oral testimony, we will begin with questions, and each Member, again, will have five minutes.

Mr. Kinzer.

Panel IV:

TESTIMONY OF MR. JOHN F. KINZER, PROGRAM OFFICER, AIR WARFARE AND WEAPONS, OFFICE OF NAVAL RESEARCH

Mr. KINZER. Thank you, Mr. Chairman. I have been the program manager of the DP–2 program since May 2003. I am a retired Navy Captain with a master's degree in aeronautical systems, operational experience in the F–4 and F–14, 680 carrier landings, and I am a Test Pilot School and Top Gun graduate. I have been a program manager at ONR and DARPA for the last ten years.

duPont Aerospace Company has been under contract to ONR to demonstrate the capabilities of the DP–2 concept since January 1998. To do this, they have designed and fabricated a one-half scale demonstrator aircraft designated the DP–1. Last fall, the program conducted its most concentrated testing since its start. Unfortunately, the program did not succeed yet in achieving extended hover and also experienced engine operating problems in ground effect.

After an extensive review this spring, the program has just reentered the test phase, which will continue through the end of the current contract in December of this year. Right now, there are no plans to continue the program beyond the current contract.

Thank you for the opportunity to appear. I will now answer any questions.

[The prepared statement of Mr. Kinzer follows:]

PREPARED STATEMENT OF JOHN F. KINZER

Mr. Chairman and Members of the Subcommittee:

I would like to thank the House Science and Technology Subcommittee on Investigations and Oversight for providing me with the opportunity to testify here today.

The DP–2 project objective is to develop the technology for a vertical take-off transport aircraft that can be used in both military and civilian roles. The design concept of the DP–2 aircraft, as proposed by the duPont Aerospace Company (DAC), is a transport aircraft asserted to be capable of carrying 52 passengers with a range of approximately 5,000 miles and a top speed of approximately 545 knots. The possible uses of the aircraft include sea-based logistics support, search and rescue, as well as special operations for the military. In the commercial world the proposed aircraft could potentially provide high speed, long-range passenger service to airports with short runways or small landing areas.

The DP–2 concept was originally laid out by DAC in 1972. It was formally studied in various forms by the Department of Defense (Air Force, Navy, and Advanced Research Projects Agency) at least four times between 1984 and 1991. Congress also authorized and/or appropriated funds for DP–2 demonstration in Fiscal Years 1988, 1991, 1993, and 1997. Most of these events centered around the suitability of the concept to meet the need for a long range special operations forces air exfiltration system. In 1996, DAC did conduct a funded full scale demonstration of its thrust vectoring system for the Defense Advanced Research Projects Agency.

Assessments of the DP–2 concept have highlighted several significant risks which could potentially require major design changes. These include engine failure during vertical takeoff, adverse induced flow in ground effect (suckdown), and hot gas ingestion. Other risks which could compromise utility include jet blast effects, radar signature, limited range/payload, composite material use in the exhaust hot section, control instability and cross coupling, low directional control power, and noise.

The current project was initiated in the Office of Naval Research in Fiscal Year 1997 with the goal of demonstrating the vertical take off system proposed by the duPont Aerospace Company. The development plan was first to fabricate two half scale composite demonstrator aircraft, with a substantial composite manufacturing subcontract to Raspet Laboratory of Mississippi State University. These aircraft, designated DP–1, would be used to perform unmanned ground tests to demonstrate the thrust vectoring characteristics of the DP–2 aircraft. Technical issues to be addressed included suitability of composite structure in the exhaust hot section, vertical takeoff performance, hover performance and handling, and suckdown and hot gas ingestion in ground effect. Test facilities were fabricated and installed at the contractor's facility in El Cajon, CA. Following vertical take-off and landing and hover tests, the DP–1 aircraft could be used to explore conventional flight, with emphasis on transition to and from vertical flight. The demonstrator aircraft have been designed for unmanned, automated flight control. This allows for an aggressive development and test approach without risk to a pilot.

Progress on the program has been very slow. This can be attributed to contractor inexperience, novelty of the design, insufficient funding to pursue parallel approaches to reduce risk, and working to short-term goals as a result of year-to-year funding. Several significant setbacks have been encountered which required component redesign and demonstrator aircraft repair. In 2005 it was decided to assemble the best components available into a third generation configuration, designated DP–1C.

Recently some progress has been made in out-of-ground effect hover tests. Forty-nine hover attempts were conducted from July 19 to October 5, 2006. None of these attempts resulted in controlled hover for more than a few seconds. Data from these tests were analyzed and modifications to thrust control and tether configuration have been implemented. Hover testing is scheduled to resume later this month. Due to the restrictive nature of tethered hover testing, there may not be sufficient freedom of maneuver in the existing test facility to achieve extended hover. However, given the progress made in conduct of test operations, and the design improvements, longer hover durations are expected.

Tests have also been conducted with the aircraft on the ground to assess ground effects. These tests have resulted in engine stalls at relatively low power, indicating possible hot gas ingestion, pressure fluctuations at the inlet due to nose landing gear vortex shedding, or inlet cross coupling. Instrumentation and test plans have been developed to further investigate this phenomenon later this summer. At this time it seems unlikely that full thrust engine operations in ground effect are achievable with the current design. Additional data will help to identify design changes, if necessary.

A test fixture for measuring forces and moments generated by the thrust vectoring system at all retraction angles and all control combinations at up to full thrust has been designed and purchased. Installation at the El Cajon facility has begun and is planned for completion this summer. These data will provide valuable inputs for the manned flight simulator to begin evaluation of handling qualities in transition maneuvers between conventional and vertical flight.

Current program funding provides for development and test operations through December 31, 2007. This will allow for conduct of the test operations described above. If further funding becomes available, testing and design development will continue to focus on hover performance and handling and operations in ground effect. These can be continued until vertical takeoff and landing can be achieved from the ground, and the hover envelope can be expanded to explore wind and maneuver limitations. Flight operations beyond low altitude hover cannot be undertaken until risk reduction activities, such as wind tunnel and/or model testing have been conducted. In addition, the aircraft would have to be redesigned to provide sufficient capability and reliability to satisfy range safety requirements for the test site. This level of complexity would require a substantial increase in engineering experience , and a substantially increased level of funding.

Suitability of the DP–2 concept for either military or commercial applications has not yet been demonstrated. Data gathered to date do not allow for technical conclusions to be drawn, or for the previous assessments to be refuted or confirmed.

BIOGRAPHY FOR JOHN F. KINZER

John F. Kinzer is a native of Gainesville, Florida, and a 1973 graduate of the University of Florida, where he earned a Bachelor of Science degree in Engineering Science. He was commissioned as an Ensign in the Navy in May 1973 through the Aviation Reserve Officer Candidate (AVROC) program, was designated a Naval Aviator in May 1975. While in flight training, he earned a Master of Science degree in Aeronautical Systems at the University of West Florida.

Navy operational assignments include Operations Officer in Fighter Squadron 41, flying the F–14A Tomcat, and Quality Assurance Division Officer and Landing Signal Officer in Fighter Squadron 161, flying the F–4J Phantom II. He accumulated 680 carrier arrested landings during deployed operations. Shore assignments include Tactics Phase Leader and Landing Signal Officer at Fighter Squadron 121. While at VF–121, he graduated from the U.S. Navy Fighter Weapons School (Topgun). Following graduation from the U.S. Naval Test Pilot School in 1981, he served as F–4S Project Officer at the Naval Air Test Center Strike Aircraft Test Directorate prior to returning to USNTPS as Senior Systems Instructor. His flying experience includes over 3,200 flight hours in over 35 different aircraft types.

Designated an Aerospace Engineering Duty Officer in September 1989, John served in the Naval Air Systems Command at the F–14 Class Desk, and with Program Executive Officer, Air ASW, Assault, and Special Missions Aircraft, as the T45 Training System Deputy Program Manager for Systems Integration. He completed the Program Manager's Course at the Defense Systems Management College (DSMC) in June 1990. He was assigned as Co-Director of the A–12 Evaluation Team for two years, and finally as Deputy Head of the Weapons, Marine Corps and Special Programs Department at the Office of Naval Research. He retired as a Captain in September 1999.

John was the Aircraft Technology Program Officer at the Office of Naval Research until 2004, then was detailed to DARPA for two years as the X–47 Program Manager in the Joint Unmanned Combat Air Systems (J–UCAS) program. Since returning to ONR in 2006, he has been assigned as the Deputy Director of the Air Warfare and Naval Weapons Division. This Division has responsibility for the Electromagnetic Railgun Program, Future Naval Capabilities, and other demonstration programs.

Military decorations include the Legion of Merit, two Meritorious Service Medals, Navy Commendation Medal, Navy Achievement Medal, Navy Unit Commendation, Meritorious Unit Commendation, Battle "E" Award with two stars, the Sea Service Ribbon with two stars, and several others. Civilian decoration is the Defense Meritorious Civilian Service Award.

John is married to the former Virginia Grimes of Amarillo, Texas, and has three children; Nicole, Catherine, and John.

Chairman MILLER. Thank you. Mr. Kinzer, you are gloriously within your time.

Mr. Hall. I am not sure your mike is on. You need to press the green button until it illuminates.

STATEMENT OF COLONEL G. WARREN HALL (RET.), NASA AMES CHIEF TEST PILOT AND CHAIRMAN OF THE DP–2 AIRWORTHINESS REVIEW PANEL; ASSISTANT DIRECTOR FOR AVIATION, AMES RESEARCH CENTER

Colonel HALL. Here we go. Mr. Chairman, Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss my technical knowledge of the duPont Aerospace Company's DP–2 aircraft program. Since I have submitted a detailed statement for the record, I will keep my introductory remarks short.

My testimony today is based on my technical background as the Chairman of the NASA Ames Research Center's Airworthiness and Flight Safety Review Board, which evaluated the DP–2 aircraft while funded by two Congressional earmarks to NASA in Fiscal Year 2002 and Fiscal Year 2003. Separate from that funding directed by Congress, NASA has never included funding for the DP–2 in the agency's budget requests.

As Chairman of the NASA's Airworthiness and Flight Safety Review Board, I assembled a team of highly qualified experts to review the DP–2 program. Under NASA's procedures, an airworthiness flight safety review has the authority to allow a project to proceed, or require further documentation or demonstrations to satisfy any airworthiness and flight safety concerns of the Board. The NASA Board met in July 2003.

When NASA's earmarks concluded at the end of Fiscal Year 2003, the Navy began overseeing the flight requirements for the DP–2 program, given that the Navy was continuing to receive Congressional funding for the program. At the Navy's request, I and several other members of NASA's Airworthiness Review Board were asked to continue serving as technical experts to the Navy, which was now solely in charge of the DP–2 program. I was asked to remain and serve as their Chairman.

My technical expertise was and is paid for by the Navy via reimbursable work agreement, which means that the Navy has paid NASA for my travel related to any activities as a technical advisor on this program. NASA also has provided the Navy with other technical expertise, and loaned equipment on a short term basis related to the DP–2 program.

Mr. Chairman, that concludes my introductory remarks. I will be happy to answer any questions.

[The prepared statement of Colonel Hall follows:]

PREPARED STATEMENT OF G. WARREN HALL

Mr. Chairman and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss my technical knowledge of the duPont Aerospace Company's DP–2 aircraft program.

My testimony today is based on my background as the Chairman of the NASA Ames Research Center's Airworthiness and Flight Safety Review Board (AFSRB), which evaluated the DP–2 aircraft while funded by two Congressional earmarks to NASA; one in FY 2002 for $3 million, and the other in FY 2003 for $4.5 million. Separate from the funding directed by Congress, NASA has never included funding for the DP–2 in the Agency's budget requests. For the Subcommittee's information, I have appended to my testimony a copy of NASA's July 2003 report from the AFSRB, which I chaired.

I continue to serve as a member of the Navy's Airworthiness Review Panel, which is currently overseeing the flight requirements for the DP–2 program. My technical expertise was, and is, paid for by the Navy via a reimbursable work agreement, which means that the Navy has paid NASA for my travel related to my activities as a technical advisor since FY 2004. NASA also has provided the Navy with other technical expertise and loaned equipment on a short-term basis related to the DP–2 program via the same reimbursable work agreement.

In the invitation to testify, you asked that I address five issues. The remainder of my testimony addresses these five issues as outlined below.

1. Please provide an overview of your role with the DP–2 program as Chairman of the DP–2 Airworthiness Review Panel and when and why the panel was created.

NASA became involved with the duPont DP–2 aircraft in FY 2002 when Congress earmarked $3 million to NASA, for the "purchase of two upgraded jet engines requiring configuration changes to the DP–2 Vectored thrust testbed aircraft." NASA has well-defined requirements that must be met for NASA-related aircraft projects. One of these is that *all* aircraft used to conduct flight operations with NASA personnel or NASA equipment on board must meet NASA approved airworthiness and operational safety standards. This policy requires that an AFSRB oversee aircraft operations, with the board having final approval authority for all flight operations. NASA is one of the few agencies with the authority to certify aircraft.

The funding directed by Congress was managed by NASA's Glenn Research Center (GRC), making GRC responsible to meet the NASA requirements for the AFSRB approval for the duPont DP–2 aircraft. Given that the aircraft was located on the West Coast and given that NASA believes that work should be located wherever there is technical expertise, GRC requested that NASA's Ames Research Center (ARC) accept responsibility for evaluation of the DP–2 by ARC's standing AFSRB because ARC has technical expertise in vertical lift aircraft and is located in Mountain View, California.

In FY 2003, Congress again earmarked funding to NASA of $4.5 million for the "DP–2 Vectored Thrust Program."

In 2003, I was Chair of the NASA Ames' AFSRB. As Chair, I have the authority to identify experts to serve as board members to accomplish a comprehensive flight safety review. A highly qualified team was assembled for the DP–2 review. The AFSRB has the authority to allow a project to proceed or require further documentation or demonstrations to satisfy any airworthiness and flight safety concerns of the Board. The NASA AFSRB review occurred at the duPont facility on July 29–31, 2003. Teleconference calls were more frequent, but they were not considered a part of the formal AFSRB review process.

NASA did not receive further direction from Congress regarding the DP–2 aircraft following the FY 2003 earmark. Consequently, the NASA requirement to provide airworthiness authority over the DP–2 was no longer required. Once the Navy was solely financially responsible for the DP–2 program, the Navy's Airworthiness Review Panel, through the Office of Naval Research (ONR) had, and continues to have, the responsibility for the final flight approval either through the Naval Air Systems Command or through the Federal Aviation Administration.

However, the Office of Naval Research and duPont believed the NASA AFSRB was doing a good job and thus asked some of the AFSRB members, myself included, to continue serving as technical experts to the DP–2 program given that the Navy was continuing to receive Congressional earmarks for the program. In February 2004, the Navy and NASA entered into a Space Act Agreement, which included a provision for the Navy to reimburse NASA for my travel spent as a technical expert on the DP–2 program. NASA also has provided the Navy with other technical expertise and loaned equipment on a short-term basis related to the DP–2 program via the same reimbursable work agreement.

In short, my current role on the Navy's DP–2 Airworthiness Review Panel is as a test pilot/flight controls/safety representative and as its Chairman.

2. As Chairman of the DP–2 Airworthiness Review Panel, please describe the key technical and safety factors inhibiting the successful flight of DP–2.

Below are some observations as a technical expert in this field:

- The complex flight control system is the biggest technical problem. The flight control system in the DP–2 is mechanically simple, but dynamically complex. Unlike most airplanes the DP–2 has what is known as a "non-minimum phase zero" response to a control input. This means the aircraft starts in the wrong direction for almost a full second before it goes in the direction requested. While not an Achilles heel, the flight control system requires very high frequency inputs to reduce this delay to a flyable time. The control system responses are also highly coupled, in that a control input in one axis creates an attendant movement in another axis.

- It is not obvious that the current composite materials will withstand the high temperature environment required to provide aircraft lift and control.
- The required expertise to accomplish the task does not currently exist at duPont Aerospace.

3. Please describe the key management factors that you believe are attributable to the duPont Aerospace Company that have hindered the success of the DP–2 program.

While the DP–2 vertical-lift aircraft may be an interesting concept worth exploring, I do not believe the duPont company has the necessary technical expertise required for this project. While a flight control simulation model now exists, it has yet to be proven that it represents the real airplane. DuPont's insistence in trying to fly the airplane within the current restrictions of the tethered area has resulted in several hard landings. NASA's AFSRB and the follow-on Navy Review Panel have consistently requested that duPont increase the usable flight test area by a significant amount. Many of the recommendations of the AFSRB were ignored. For example, the Board was very specific that the only time a pilot would be in the aircraft was to start the engines and accomplish checkout at idle. The pilot clearly exceeded the idle limits during the incident on November 16, 2004, when a structural failure occurred.

4. Please briefly describe each specific mishap or accident with the DP–2 aircraft and the technical and management factors that contributed to each event.

My expertise as the AFSRB Chairman is of a technical nature, and therefore I am best qualified to comment on the technical issues related to the following mishaps and accidents:

1. November 2, 2003—The DP–2 airplane experienced a hard landing resulting in damage to the left and right main landing gear attach points and the thrust vectoring mechanisms beneath the fuselage. Additional damage to both wing tips and the left tether attachment point was sustained. It was concluded that the loss of the dGPS carrier signal, combined with the simultaneous reading of zero for the height rate signal caused the accident. The AFSRB concurred with this finding.
2. November 16, 2004—An internal structural failure resulted in damage to the nozzle box, keel, cascade mechanism, thrust vectoring controls, cabin floor, cabin door latch mechanism, pilot's seat floor mounting brackets, and a computer cooling fan blade. One or both lower doors were jammed against the nozzle box floor preventing full motion of the cascades resulting in keel failure. The most probable cause was debonding in the area of the carbon insert encapsulating the "Dog Bone." While not related to the structural failure, the pilot exceeded the AFSRB's instructions that engine rpm shall not exceed idle RPM when a pilot is in the cockpit. The AFSRB concurs with this finding.
3. April 25, 2006—The DP–2 experienced a failure in a carbon composite insert and a titanium piece which holds the cascade pivot and cascade actuator. The failure resulted in damage to the nozzle box keel, left nozzle box sidewall, control rod for thrust vectoring controls, cabin floor, the cabin door and frame and the number two engine inlet. The AFSRB concurred with this finding.
4. August 8, 2006—The DP–2 experienced a hard landing resulting in damage to the wing skin near the landing gear attachment. The most probable cause was an unknown altitude rate bias in a loaner Inertial Navigation System causing excess rate of climb. The AFSRB concurred with this finding.

5. Since the DP–2 Airworthiness Review Panel was established in 2003, what has the duPont Aerospace Company accomplished on the DP–2 program?

Based on my continued advisory role, I can summarize some of the program's accomplishments as follows:

- The structural components have been improved;

- The hot gas ingestion problem has been recognized and tests performed to help reduce its deleterious effect in hover; and,
- An improved flight controls simulation model now exists. However, the short hover times have precluded confirmation that the model matches the real airplane.

Mr. Chairman and Members of the Subcommittee, thank you for this opportunity to appear before you today. I would be happy to answer your questions.

Attachment

DP–1 AIRWORTHINESS REVIEW PANEL
JULY 29–31, 2003

Panel Report

This report presents a summary of the Airworthiness Review Panel (ARP) findings following the meeting at the duPont Aerospace Company (DAC) on July 29–31, 2003. The report is presented in two sections. The first section contains the principal findings regarding testing of the DP–1 aircraft and the second section contains suggestions/recommendations that DAC may wish to incorporate into their program plan.

I. Principal Findings: Flight Safety Action items and Approval for test

1. DAC is authorized to conduct tethered unmanned autopilot controlled hover, OGE and IGE. The GFR (Major Temper) must still sign and approve the day-to-day flight release documents and the tests should be conducted in accordance with the Test Plan for Tethered Hover dated 2 July 03, with Change 1.

2. The current level of design and testing of the DP–1 aircraft is not mature enough to allow manned flight—tethered or untethered. Another panel review must be accomplished prior to tethered manned operation.

3. In preparation for the next test block approval (manned tethered hover, OGE, and IGE), DAC must address each of the following action items and present the results to the ARP at the next review meeting. This review should concentrate on the DP–1 vehicle only.

a. A strong configuration management program is required and very close attention must be paid to how a configuration change might affect the characteristics of the original configuration. It has always been a good philosophy to test what you fly and fly what you test. With the limited amount of testing proposed, it is vital that the implications of any change, especially as it might affect safety, be fully evaluated. As part of this program, identify DP–1 aircraft and engine configurations for different tests (already accomplished and in the future).

b. Present data obtained from the autopilot controlled unmanned tethered hover tests. Establish through these tests and information that the DP–1 aircraft can be safely and reliably controlled in hover with the autopilot installed and operating.

c. Implement a viable Safety and Quality Assurance Program that includes Test Hazard Analysis and Failure Modes and Effects Analysis (FMEA).

d. Establish normal and emergency procedures to be followed during the manned tethered hover testing.

e. Develop a means to ensure that the air quality in the aircraft is acceptable for extended occupancy under test conditions.

f. Convincing evidence must be presented to the panel on the measured forces and moments that will be available to control the aircraft with the cascade locked at 90° and the control box moving. The lack of hard information in this area leads the panel to question the validity of the flight simulator.

   There is also a need to further verify the validity of the fixed based simulator by comparison with flight test data from tethered hover, autopilot installed and operating. The need is to demonstrate that the aircraft can be safely and reliably controlled by the pilot in hover through the use of pilot-in-the-loop simulations with and without the autopilot operating. Present the results of test practice in the piloted simulation, updated to reflect the results of testing to date. A valid flight simulator is required for pilot training and flight test preparation. It is imperative that any configuration changes that influence the handling qualities be documented and included in the simulation. This is a major safety of flight action item.

   [It will be desirable to hear a report from Ron Gerdes if he has an opportunity to fly and assess the simulator before the next ARP meeting.]

g. Provide information and results on the methods used to determine the thrust loss through the cascade plus control box. An independent measurement(s) [other than the current flow analysis] could give greater confidence in the thrust loss values. It is suggested that DAC consider the suggestions presented in Section II, item 8, of this report.

h. Complete for review an updated stability analysis of the aircraft and control system, and control analysis including the most up-to-date actual control system characteristics. [Suggest using Geneva's six degrees of freedom simulation.] Include stability analysis of altitude control, as well as lateral position/attitude control. Include cases with a man-in-the-loop model. Show time histories of simulated control scenarios. Include Monte Carlo analysis to show the cumulative potential effect of all tolerances and uncertainties.

   It may be difficult to develop a control scheme that will handle the long non-minimum phase response to a control input. Observations of the pilot flying the simulator without the autopilot were indicative of an acceleration controller, a difficult control system to fly because of the requirement for continuous attention to control. The excellent stability of the autopilot mode, however, indicates there was an acceptable method of handling the non=minimum phase response but it was never revealed what it was. Past experience with fly-by-wire systems indicates that a simple response lag of 0.1 to 0.2 seconds often resulted in limit cycles or unstable responses.

i. Update the test plan, limits document, and training plan.

j. Provide substantiation (analyses, tests, similarity, etc.) of the structural limits of the landing gear and its attachments when subjected to a high sink, sideslip, or one wheel landing, that could occur during hover testing.

k. Present a structural substantiation and service history to date for the items in the jet exhaust (especially vanes, pushrods and attachments). Emphasis should be placed on the expected service life of these components.

l. Identify flight critical items and insure that any that are replaced and/or modified are reviewed for time at power settings to determine safest configuration for manned tethered flight. Only fly an approved configuration with particular attention to the operating times of components especially those subjected to high temperatures. A criterion for critical parts should be established and adhered to. As part of this action item, identify required inspections of cascade box, vanes and control box and vanes prior to manned tethered flight. The panel believes there should be an "endurance" test of the power train, including cascades and control vanes. Toward this end DAC should specify the time and power for this endurance test for ARP approval.

m. Present a further review (including analyses and simulation results) of emergency procedures that will be used in the event of an engine failure while in the tethered hover mode (IGE or OGE).

n. The control system configuration must be carefully managed. If the system to be used in tethered hover testing does not have all surfaces, artificial feel packages, conventional flight trim system hardware, etc. installed, then this must be consistently replicated in all analyses and simulations since these items may influence the response of the control system in the hover mode. Prior to free flight all these devices must be in the aircraft, and if this is different from the tether test configuration the tests must be repeated.

4. The current level of engineering substantiation and program planning and control fall well short of what will be necessary to conduct safe and productive free flight (both thrust-borne and conventional) tests. The risk mitigation provided by the tethers allows tethered testing to proceed for the time being. However, prior to free flight tests substantial progress must be made. The following are areas that require action.

a. Testing and analyses to substantiate airworthiness in all functional areas (structures, aero, propulsion, flight controls, subsystems, flutter, avionics, etc.) is needed.

b. A further review of aircraft systems will be required including FMEAs (for the planned flight conditions) and the results of any systems tests—specifically identifying single point failures and their risk mitigation.

c. Additional reviews will also be required in the following areas:

   - Aircraft maintenance program
   - Aircraft software validation and verification plan
   - Flight test program history and reliability

d. Quality control plan developed and fully implemented.

e. All aircraft components individually reviewed for airworthiness; compiled in a database with airworthiness rationale (environment established and suitability by qual test, similarity, etc.) All parts exposed to an endurance test in the jet exhaust should be inspected prior to manned flight. (see also item 3l).

f. Complete test documentation (detailed test plan, test hazards analysis, training plan, normal and emergency ops, limits document)

g. From a structural integrity perspective, the following will be needed. Low speed (< 200 ktas)—detailed review to include:

- external flight and landing loads
- composite material qualification data
- stress analyses of airframe and flight control system
- test data from coupons, elements and subcomponents
- proof load test plan and results
- aeroelastic substantiation (flutter, divergence, aileron reversal)—include consideration of balance weights in the control surfaces
- an aircraft structure Failure Modes and Effects Analysis including hazard analyses

High speed (>200 ktas)—A repeat of items in the above list, except a more stringent requirement. Loads analyses should include aeroelastic and compressibility effects. Rational flutter analysis and a ground vibration test will be recommended. A variable frequency inflight excitation system, with appropriate frequency range will be recommended for envelope expansion above 200 ktas. A telemetry system with appropriate sensors will be recommended.

h. A Failure Modes Analysis of the software should be accomplished to identify any unsafe failure modes. Critical paths should be identified and shown to be reliable and-controllable. This is especially important since the autopilot system is single string. It should be demonstrated that the autopilot design is adequate and reliable prior to piloted flight.

i. More information will be needed on pilot emergency escape systems and procedures. Serious consideration should be given to the addition of an ejection seat system. And a good field-of-view is highly desirable during the "build-down to V/STOL (powered lift) flight conditions at altitude.

j. More analysis and substantiation data is need on the fuel management system and CG control. Automated fuel transfer is required to reduce pilot workload and assure proper CG location as fuel is being consumed, especially during V/STOL operations. A center of gravity vs. fuel consumption diagram should be provided.

k. It doesn't appear that the DP–1/DP–2 configuration has a VTO OEI capability, and the engine failure "dead zone" analysis seems overoptimistic. Calculate actual dead zone dimensions for takeoff, landing and hover cases using updated data. Include control effects: loss of directional control, and need to roll away from dead engine to maintain control.

The vertical take off procedure is to first lift to a 10-ft. hover followed by a transition to forward flight with thrust vector (cascade) movement. In the event of an engine failure, the procedure is to nose down a little and vector-out. A two to 10 second thrust decay is assumed in the calculation. At 10-ft., the aircraft is probably still in ground effect, which would reduce single engine performance. A mechanical failure would be more instantaneous and nosing over in combination with 'vector out' would probably cause the aircraft to fall to the ground. This is OK on a long runway, but hazardous when operating from a pad for instance.

l. An accurate and sensitive air data system is needed during V/STOL flight test for a number of important reasons: 1) for pilot reference, especially during the build-down to powered lift flight, 2) for flight test data documentation and analysis, 3) for control room flight test monitoring, and 4) for autopilot and SCAS air data input requirements. Details on the proposed system will be needed.

m. There will probably be other "unknown Handling Qualities Issues" that must be addressed. The following is a short listing of other issues that could impact handling qualities

Tether-induced moments

Ground effect induced forces and moments

Control actuator bandwidths—dynamic response

Autopilot and/or SCAS failure control transients

Control servo or boost failure controllability

n. A stall in one engine may interact with the inlet of the other engine. When one engine goes out, it leaves pressure surges in various places that could potentially interrupt the operation of the nearby second engine. Likewise, the failing engine could also leave vacuum like conditions in various places that could influence the behavior of the second nearby engine. DAC needs to address this, probably by running test stand tests, and perhaps by analysis.

o. Demonstrate that the $C_{M\alpha}$ inversion around 12° to 20° angle of attack is not a serious concern with respect to *very low* speed flight. As reported by DAC at the meeting, this inversion was observed on other F–8 super-critical wing data and seems to be very Reynolds number sensitive. So much so that for the full scale Reynolds number corresponding to conventional flight of the DP–1 aircraft it appears that the inversion is almost wiped out. But as the aircraft is slowed down (as it transitions to hover with lower and lower Reynolds numbers) there is a possible pitch up.

Note that panel member Ron Gerdes flew one (the last) evaluation flight in the Vought F–8 SCW aircraft which included approaches to stall and other slow flight evaluations. The longitudinal flight control system of the basic F–8A was modified (command augmentation system or CAS) with an apparent rate command + attitude hold system to 'stiffen the pitch axis.'

p. Hot gas ingestion and suckdown have been major issues on practically every VTOL plane to date. It was very troublesome on Harrier and JSF, although the thrust levels on these two types of planes were much higher than DP–1. In ground effect testing must be designed to address this:

(1) Test Airplane DP–1 must sit on its landing gear which in turn sits on the ground.

(2) The "FLAT" ground must extend out for hundreds of feet in all directions.

(3) Ground surface under, and near the plane, should be solid.

(4) Accurate force and moment measurements must be taken as described in paragraph 3.e. above.

(5) Optical and IR measurements should be taken to more thoroughly characterize the hot gas flows. (NOTE: NASA GRC has volunteered to help with these measurements.)

II. Suggestions, Additional Recommendations and Comments

The following are suggestions that may prove helpful in managing the program or conducting tests.

1. Suggest the use of DP–1A to represent the aircraft as it existed with P&W 530 engines, DP–1B same as 1A with 535A engines, DP–1C new fuselage, MOD wing attachments and 535A engines, etc.

2. Identify DP–1 Master Test Plan with aircraft configuration (DP–1A, DP–1B, etc.) and put major milestone accomplishments into phases.

3. In addition to the Master Test Plan mentioned above, an overall integrated program plan is needed that shows all testing, including building block tests (e.g., wing proof test) and configuration changes (e.g., fuselage change, cascade change).

4. All data presented should include standard legend: configuration, date, test conditions.

5. Aircraft instrumentation appears to be very limited. Analysis to substantiate test progression, envelope expansion and performance prediction will be severely hampered if test data are incomplete.

6. Measurements of the mechanical distortions of the cascade and control box while the engines are running would help in further sensitivity studies using the Genevas's six degree of freedom simulation that is set up with the automatic flight control system. At the present time we are guessing at what these mechanical distortions may be and it would appear that a few measurements could lead to many beneficial runs on the simulator—thus saving run time on the test stand. At the very least it would be very desirable to instrument the control surface positions while the engines are operating.

7. Wind tunnel measurements of the gas flow in the cascades would be useful. As the cascade is retracted from 90 degrees the flow entering the cascade will be at some off design angle. The possible flow separation and blockage effects for these off design positions could be determined from a well designed set of wind tunnel tests. The side walls could be made of transparent material for optical visualization of the flow. This would be helpful in determining the cascade effectiveness at these partially retracted positions; and these measurements could also include tests with the control box installed to help determine the exit flow angles.

8. Perform wind tunnel tests of the flow mixer under realistic flow conditions to determine effectiveness of the mixer design and temperature uniformity and levels of the flow upstream of the cascade. The tests can be done on a scaled down model however the Mach number ratio and temperature ratio must match those for the real engine.

9. DAC should consider measuring engine N1 (plus P&W cycle deck), fuel flow, and aircraft weight to obtain an accurate measure of the vertical thrust coefficient. A bigger payoff would be obtained by installing load cells on solid piers that are mounted down through the test stand into the hard ground below. Force measurements on those load cells should provide accurate thrust measurements and those values could, in turn, be used to calculate the control moments acting on the aircraft.

10. Before low speed taxi tests are begun, and prior to being moved to the flight test facility, the DP–1 aircraft could be disassembled, fitted with the improved fuselage, and have all of the new flight test instrumentation and wiring installed.

11. The basic objective of demonstrating VSTOL performance, stability and control from hover through transition to and from conventional flight could be accomplished without the degree of envelope expansion contemplated for the conventional flight test program, i.e., Mach 0.95, VCAS 355 kts, altitude 50,000 ft. In order to approve the DP–1 for these tests, considerably more substantiation, involving analysis and test, will probably be required.

12. It might be noted that the use of a steel grid platform only slightly larger than the aircraft overall length and wingspan, located approximately 10 feet above the ground may not be a valid representation of true out of ground effect operation.

13. It was not obvious that the wind tunnel data was applicable to the DP–1 configuration. Additional wind tunnel data would be very useful.

14. Any person who has to be near the engine inlet at above idle power must be tethered.

15. The final decision with respect to flight risk assessment by DAC should rest with the Test Pilot, Larry Walker.

16. The overall programmatic/demonstration approach outlined by DAC appears reasonable, namely:

1. Tethered hover out of ground effect, no pilot on board
2. Tethered hover in ground effect, no pilot on board
3. Tethered hover in and out of ground effect, pilot on board with autopilot and pilot only
4. Low speed taxi tests
5. Free flight hover tests from lift off to 20 foot altitude
6. High speed taxi tests
7. Conventional flight tests, envelope expansion
8. Transitions from conventional flight to jet-borne flight
9. Vertical takeoffs and landings

BIOGRAPHY FOR G. WARREN HALL

After graduating from the University of Virginia in 1960, with an undergraduate degree in Aeronautical Engineering, Mr. G. Warren Hall became a Naval Aviator logging more than 300 carrier landings in the F3B Demon and F4B Phantom II aircraft.

Mr. Hall began his flight test career in 1965 as an Engineering Test Pilot with Cornell Aeronautical Laboratory of Cornell University where he logged over 100 hours in the Bell X–22A V/STOL aircraft. While at Cornell, he completed a Master's Degree in Aerospace Engineering. He also has a MBA from the State University of New York at Buffalo, New York.

Mr. Hall joined NASA's Ames Research Center in 1977 as a Research Test Pilot. He has flown over 65 different types of aircraft including the X–14B, XV–15 and the unique Rotor Systems Research Aircraft. He is a Fellow in the Society of Experimental Test Pilots. At NASA he has served as the Director of the Flight Research and Airborne Science Directorate and the Safety, Environmental and Mission Assurance Directorate. He is currently the Assistant Director for Aviation at Ames. He was awarded a NASA Exceptional Service medal in 1994 and a NASA Outstanding Leadership medal in 2000.

He completed 28 years of military service before retiring as the Commander of the California Air National Guard's 129th Rescue and Recovery Group at Moffett Field, California with the rank of Colonel. He was awarded the Air Force Legion of Merit in 1989.

Professionally, he has authored 28 technical reports and 45 technical papers or journal articles.

In December 2003, the San Francisco Chapter of the American Institute of Aeronautics and Astronautics designated Mr. Hall as a "Living Legend of Aerospace." In November 2004, Mr. Hall was inducted into the Virginia Aviation Hall of Fame.

Chairman MILLER. Also gloriously within the time allowed. Lieutenant Colonel Tremper.

Lieutentant Colonel TREMPER. Sir, I would like Ms. Greening first.

Chairman MILLER. Okay.

STATEMENT OF MS. MARIE GREENING, EXECUTIVE DIRECTOR, AERONAUTICAL SYSTEMS DIVISION, DEFENSE CONTRACT MANAGEMENT AGENCY

Ms. GREENING. Yes. Sir, I am the Director of the Aeronautical Systems Division at Defense Contract Management Agency. DCMA is the Department of Defense component that works directly with defense suppliers to help ensure that DOD, federal, and allied government supplies and services are delivered on time at projected costs, meeting all performance requirements.

One of DCMA's roles is to serve as the in-plant representative for military, Federal, and allied government buying agencies, both during the initial stages of acquisition cycle, and throughout the life of the resulting contracts. The assurance of safe ground and flight operations at these defense plants is included in DCMA's mission area.

With me today is Lieutenant Colonel Michael J. Tremper, United States Air Force Reserve. Lieutenant Colonel Tremper is presently assigned to the 4th Air Force Headquarters Plans and Programs Staff at March Air Reserve Base in Moreno Valley, California. From 1999 through 2006, Lieutenant Colonel Tremper was assigned to the DCMA District West Flight Operations in Carson, California, and DCMA Palmdale, California, where he served as the government flight representative, or GFR, for several programs being procured by various agencies, including the Missile Defense Agency, the Defense Advanced Research Projects Agency, the Office of Naval Research, and the National Aeronautics and Space Administration.

Lieutenant Colonel Tremper served as the GFR for programs ranging from unmanned aerial vehicles to manned airborne sensor platforms. Included in these programs was the duPont DP–2. Currently, in response to critical manning levels, Lieutenant Colonel Tremper maintains concurrent responsibilities as the GFR for DCMA Palmdale, California, as well as performing his duties at the 4th Air Force Headquarters Staff.

As the GFR, his primary responsibility is to ensure compliance with the tri-service contractor flight and ground operations instructions. In addition to his military duties, he is a Boeing 767 international pilot for Delta Airlines, and I present to the Subcommittee Lieutenant Colonel Michael Tremper, United States Air Force Reserve.

BIOGRAPHY FOR MARIE GREENING

Ms. Marie Greening is a native of Johnstown, Pennsylvania, a graduate of the Pennsylvania State University with a Bachelor of Science degree in Chemical Engineering and holds a Master's of Engineering degree from the North Carolina State University.

She began her career in government service in at the Naval Aviation Depot, Cherry Point, North Carolina, providing engineering support to production line and component overhaul activities for six aircraft types and developing advanced composite repair schemes for military aircraft. She subsequently transferred to the Naval Air Systems Command (NAVAIR) Headquarters in and began a ten-year association with the F/A–18 aircraft program. She first reported as the configuration manager and depot programs coordinator, responsible for the fielding of new system support and the scheduling and management of aircraft and component overhaul. Her next assignment was as the lead structural engineer for the F/A–18 aircraft, responsible for the structural integrity of the air vehicle system. She was next appointed as the Product Support Team Leader for International Programs. In this capacity she was integral to the sale of Hornets to the governments of Switzerland and Finland, the restoration of aircraft support capabilities by the government of Kuwait in the post-Desert Storm time frame, and the support of F/A–18s procured by the governments of Canada, Australia, and Spain. She was then promoted as the Product Support Team Leader for all F/A–18 aircraft and her responsibilities included logistics program management for 850 fielded USN/USMC aircraft, program development for the E/F variant and international program support. Marie was then selected as the Principal Deputy for Aviation Support Equipment at the NAVAIR and in 1999 was subsequently appointed as the Program Manager. Her responsibilities included leading a 400-person team to procure three hundred million dollars of support equipment acquisitions per year and sustaining Naval Aviation's support equipment inventory valued in excess of six billion dollars.

In 2002 she was appointed to the Senior Executive Service as the Defense Contract Management Agency's Deputy Executive Director, Contract Management Operation where she was a principal advisor to the DCMA director in the development and deployment of Agency policy and processes used to manage 350,000 defense contracts, valued at $850 billion, and a worldwide supplier base of over 20,000 vendors. In 2003 she returned to NAVAIR as the Product Support Department Head. In this capacity she was the Chief Logistician for all aircraft acquisition platforms and was responsible for the sustainability of airframe, avionic and engine commodities. In 2005 she was appointed as the Deputy Program Manager of the $1.6 billion Navy Marine Corps Intranet Program, the largest intranet in the world serving over 650,000 U.S. and Japan-based users. In 2006 she was appointed as Program Manager of both the Navy-Marine Corps Intranet and the One-Net Program, the Navy's overseas-based network. In this capacity she was responsible for all world-wide shore-based naval networks.

Ms. Greening is a graduate of the Naval Air System Command's Senior Executive Management Development Program, the Defense Systems Management College's Advanced and Executive Program Managers' Courses, and the Federal Executive Institute's "Leadership for a Democratic Society" curriculum. She is the recipient of numerous performance awards, including the Civilian Meritorious and Superior

Service Awards, has authored papers on advanced composite repair, and holds a single engine land private pilot license.

STATEMENT OF LIEUTENANT COLONEL MICHAEL F. TREMPER, DEFENSE CONTRACT MANAGEMENT AGENCY RESIDENT PILOT AT DUPONT AEROSPACE COMPANY

Lieutenant Colonel TREMPER. Mr. Chairman and Members of the Committee, good afternoon. I would like to thank you for providing me an opportunity to testify here today.

As GFR, my primary role, as Ms. Greening was testifying, is to provide operational oversight of Contractor Flight Operations. The GFR leads a three member Aviation Program Team, or APT, consisting of the GFR, a maintenance manager, and a safety specialist. The APT conducts periodic inspections of the contractor facilities and flight operations.

The results of these inspections are utilized to assist in risk assessment and mitigation of the program. The contractor is required to conduct its flight operations according to very specific contractual requirements contained in the DCMA Joint Instruction 8210.1, and it is the role of the APT to evaluate the contractor's level of compliance with these requirements. As part of the requirements, the contractor is obligated to submit the Contractor Flight and Ground Operation Procedures. The GFR is the approval authority for these procedures and for flight authorizations, including aircraft having government assumption of risk.

The duPont Aerospace program is categorized by DCMA as a non-resident program, meaning that the level of flight activity does not warrant a full-time, on-site APT. I have been assigned to this program for approximately eight years and have conducted numerous inspections of duPont Aerospace. The first inspection was conducted on January 27 and 28 of 2003. As a result of this inspection, the contractor received a "high" risk assessment rating. The program was found to be contractually noncompliant in virtually all evaluated areas of the operation, and resulted in the temporary withdrawal of GFR approval for procedures and aircraft testing.

duPont Aerospace immediately expended considerable effort to address all items of noncompliance identified by the APT. A followup assessment was conducted by the APT, and determined that the program had met minimum levels of compliance required, and the GFR approval procedures for aircraft testing. Subsequent inspections identified a considerable upward trend in program compliance with the contractual requirements.

During the development of the DP–2 program, there have been four mishaps involving the test aircraft. The first mishap occurred on 2 November, 2003, and resulted in significant damage to the aircraft. Notification was made to the Naval Air Systems Command Safety Center. Based on the contractor's damage and cost estimate and lack of injury to personnel, the mishap was placed at the Class C mishap classification level. The Safety Center authorized the contractor to conduct its own mishap investigation, and to submit the report.

The test aircraft again experienced mishaps on 16 November, 2004, April 25, 2006, and August 8, 2006. DuPont Aerospace again conducted the mishap investigations, and produced final reports for these mishaps. These reports were submitted to the GFR and to the duPont Airworthiness Review Panel.

The aircraft mishap on 8 August, 2006, was reported to NASA and the ONR ARP representatives. However, no notification was made to the GFR. I subsequently informed the contractor that this was not in accordance with approved mishap reporting procedures. At that time, I again temporarily removed government approval for contractor procedures and test authorizations until a thorough accounting of the mishap and clarification of mishap reporting procedures were provided.

The contractor conducted a mishap investigation and submitted the mishap report for review to the ARP and the GFR. After a thorough review of the test program was conducted by the duPont ARP, the GFR approval for procedures and aircraft testing was reinstated.

The DP–2 aircraft testing is currently being conducted at the duPont Aerospace facility located at Gillespie Field in El Cajon, California. GFR authorization has been granted for the continuation of both in-ground effect testing and out-of-ground effect testing tethered hover operations at the field.

As the DP–2 Research and Development program advances, the duPont APT will continue to perform its contractual oversight responsibilities, and provide risk assessment and mitigation of this contractor's flight test operation.

This concludes by prepared remarks, and I will be happy to answer any questions you may have.

[The prepared statement of Lieutenant Colonel Tremper follows:]

PREPARED STATEMENT OF LIEUTENANT COLONEL MICHAEL J. TREMPER

Mr. Chairman and Members of the Subcommittee:

I would like to thank the Subcommittee for providing me the opportunity to testify here today.

I am a member of the Air Force Reserves, presently assigned to the 4th Air Force Headquarters Plans and Programs Staff at March Air Reserve Base, California. In addition to my military duties, I am a B–767 International Pilot for Delta Airlines based in Atlanta, Georgia.

In response to critical manning levels, I maintain concurrent responsibilities as a Government Flight Representative (GFR) for the Defense Contract Management Agency (DCMA). I have served as a GFR at DCMA for approximately eight years, and have provided oversight for several programs, ranging from Unmanned Aerial Vehicles (UAV) to manned airborne sensor platforms. The programs were managed by various agencies, including the Missile Defense Agency, the Defense Advanced Research Projects Agency (DARPA), the Office of Naval Research (ONR), and the National Aeronautics and Space Administration (NASA).

As GFR, my primary role is to provide operational oversight of Contractor Flight Operations. The GFR leads a three-member Aviation Program Team (APT) consisting of the GFR, a maintenance manager, and safety specialist. The APT conducts periodic inspections of contractor facilities and flight operations. The results of these inspections are utilized to assist in risk assessment and mitigation of the Program. The contractor is required to conduct its flight operations according to very specific contractual requirements contained in the DCMA Joint Instruction 8210.1, and it is the role of the APT to evaluate the contractor's level of compliance with these requirements. As part of the requirements, the contractor is obligated to submit the "Contractor Flight and Ground Operations Procedures." The GFR is the approval authority for these procedures and for flight authorization involving aircraft having government assumption of risk.

The duPont Aerospace program is categorized by DCMA as a "Non-Resident" program, meaning that the level of flight activity does not warrant a full-time, on-site APT. I have been assigned to this program for approximately eight years and have conducted numerous inspections of duPont Aerospace. The first inspection was conducted on January 27 and 28, 2003. As a result of this inspection, the contractor received a "high" risk assessment rating. The program was found to be contractually non-compliant in virtually all evaluated aspects of the operation, and resulted in the temporary withdrawal of GFR approval for procedures and aircraft testing. DuPont Aerospace immediately expended considerable effort to address all items of non-compliance identified by the APT. A follow-up assessment was conducted by the APT, and determined that the program had met the minimum levels of compliance required, and the GFR approval for procedures and aircraft testing was reinstated. Subsequent inspections identified a considerable upward trend in program compliance with contractual requirements.

During the development of the DP–2 program, there have been four mishaps involving the test aircraft. The first mishap occurred on November 2, 2003, and resulted in significant damage to the aircraft. Notification was made to the Naval Air Systems Command (NAVAIR) Safety Center. Based on the contractor's damage cost estimate and lack of injury to personnel, the mishap was placed at the Class C classification level. The Safety Center authorized the contractor to conduct its own mishap investigation and to submit the mishap report. The test aircraft again experienced mishaps on November 16, 2004, April 25, 2006, and August 8, 2006. DuPont Aerospace again conducted the mishap investigation and produced final reports for these mishaps. These reports were submitted to the GFR and the duPont Aerospace Airworthiness Review Panel (ARP).

The aircraft mishap on August 8, 2006, was reported to NASA and ONR ARP representatives, however, no notification was made to the GFR. I subsequently informed the contractor that this was not in accordance with the approved mishap reporting procedures. At that time, I again temporarily removed government approval of contractor procedures and test authorizations until a thorough accounting of the mishap and clarification of mishap reporting procedures were provided. The contractor conducted a mishap investigation and submitted a mishap report for review to the ARP and GFR. After a thorough review of the test program was conducted by the duPont ARP, the GFR approval for Procedures and aircraft testing was reinstated.

The DP–2 aircraft testing is currently being conducted at the duPont Aerospace facility located at Gellespie Field in El Cajon, California. GFR authorization has been granted for the continuation of both in-ground effect (IGE) and out-of-ground effect (OGE) tethered hover test operations. As the DP–2 Research and Development program advances, the duPont Aviation Program Team will continue to perform its contractual oversight responsibility and provide risk assessment and mitigation of this contractor's flight test operation.

This concludes my prepared remarks. I will be happy to answer questions you may have.

Biography for Michael J. Tremper

Lieutenant Colonel Michael J. Tremper, USAFR, is currently assigned as an inspector for the 4th Air Force, Plans and Program Staff at March Air Reserve Base, California. As a residual duty, he also serves as a Government Flight Representative for the Defense Contract Management Agency, having worked on programs ranging from Unmanned Aerial Vehicles (UAV) to manned airborne sensor platforms.

In his civilian employment, he is a B–767 International Pilot for Delta Airlines, and is based in Atlanta, Georgia.

Lt. Col. Tremper is a 1985 graduate of the University of California at Long Beach, with a Bachelor's degree in public administration. He served eight years of active duty in the United States Air Force, flying KC 135 aircraft at Dyess AFB, Texas. He is a recipient of the Defense Meritorious Service Medal and Air Medal-Desert Storm.

Discussion

Chairman Miller. Thank you, Colonel Tremper.

Mr. Kinzer.

Mr. Kinzer. Sir.

DP–2 SPECIFICATIONS

Chairman MILLER. You heard Mr. duPont's assessment of the DP–2's capabilities, the range, the cruise, the payload, the capabilities generally. From your own experience and observation, was his description accurate?

Mr. KINZER. I think we disagree on that, sir. Our estimate is that the range and payload would be considerably less than what Mr. duPont would project.

Chairman MILLER. When you say considerably less, do you have an idea of about how much it might be?

Mr. KINZER. I can't say we have an authoritative study on that. We have done preliminary analyses. There are a lot of unknowns. As in any research program, the projections of aircraft weight, the efficiencies of various propulsion components, all of those things are subject to some debate, I guess, is the best way to put it.

So, I don't know that I would want to stand by any particular number, but it is certainly not anywhere approaching what he is projecting.

STATE OF THE DP–2 PROJECT

Chairman MILLER. Okay. I understand that for the next fiscal year, the next budget year, there is a recommendation of a $6 million appropriation, again, an earmark, I believe, to come back to hovering later, and trying to fly. And you have told our staff, I understand, that there was no way that that could be done safely. Is that correct, and why is that?

Mr. KINZER. Sir, I am not sure exactly what you said. There is no way what could be done safely?

Chairman MILLER. The forward, conventional forward flight.

Mr. KINZER. Conventional flight. Yes, sir. That is my assessment as the program manager, is that given the level of engineering that the company currently has, that we can't really proceed beyond the low altitude hover phase, the current approach to the program, the level of funding and the——

Chairman MILLER. And then, Colonel Tremper, in 2003, you spoke of the inspection of the duPont Aerospace Company, and your report is entered, well, I would like to enter it into the record as Exhibit 3. It may have been in the book of documents already entered. It is in the book of documents.

You wrote: "The inspection findings indicate the contractor was noncompliant throughout all areas of its operation." Could you tell us what you found?

Colonel TREMPER. Yes, sir. As I said previously, we have to ensure compliance with the tri-service regulation that define all aspects of their operation, very similar to the responsibilities of the FAA, except the FAA does not have jurisdiction, because the government has an assumption of risk. Included into this are all aspects of their ground operation, from refueling, towing, training, currency requirements, and aircraft fire protection. So, we have very specific checklists that we have to run. Each individual takes their responsibilities seriously. The safety specialist makes sure the contractor is in compliance with national fire codes, the ground specialist makes sure that the contractor is following established procedures.

We try to take the military requirements, if they are already there, for towing, jacking, things like that. But every checklist that we had, we ran through. They were essentially noncompliant. No training records, no checklists for towing. One of the things we do is give them scenarios, emergency procedures. They didn't have any kind of adequate answers that we would accept, as far as response for mishaps.

And so, we assign a numerical value. I don't have that with me right now, but it was pretty much off the chart. Like I said, they were noncompliant in essentially everything we evaluated them in. I debriefed the entire duPont staff with my team. We let them know, you know, the full magnitude, the full scope of where they failed.

To their credit, they did expend a considerable effort after that. They pretty much had to, because I had withdrawn my approval for their operation until they were in compliance. I am not sure if I answered fully your question.

DP–2 FAA CERTIFICATION

Chairman MILLER. Okay. Well, you said that they were not subject to FAA certification.

Colonel TREMPER. Right.

Chairman MILLER. Are you familiar with the requirements for FAA certification?

Colonel TREMPER. No, sir.

Chairman MILLER. You are not?

Colonel TREMPER. No, sir. It has nothing to do with our program.

Chairman MILLER. So, you are not familiar with what the FAA requires?

Lieutenant Colonel TREMPER. No, sir.

Chairman MILLER. Okay. So, you don't have any idea of whether this plane could be, or this——

Lieutenant Colonel TREMPER. As far as, you mean experimental certification with the FAA?

Chairman MILLER. Could be certified by the FAA.

Lieutenant Colonel TREMPER. I know they are out there, but they have no applicability to this program, under the flight risk clause.

DP–2 ACCIDENT RECORD

Chairman MILLER. Okay. And then, I think my final question, Mr. Hall. The DP–2 has been compared a lot today to the Osprey, but it appears that the DP–2 is still in its, the early stages of its infancy. Perhaps it is still in utero. Are four accidents to this point, only in attempts to hover, is that a reasonable good safety record, in your estimation?

Colonel HALL. That is not a good record. That is a bad record.

Chairman MILLER. Okay. Mr. Rohrabacher.

MANAGEMENT OF THE DP–2 PROJECT

Mr. ROHRABACHER. Thank you very much. And again, I would like to compliment the Chairman on holding a hearing into something, and asking questions that are very reasonable to be asked of any program that is financed by the taxpayers. And this is the way we are going to be able to find out the truth, and to make our own decisions here.

Will you all agree that engineers generally are poor managers? Any disagreement with that? I mean, am I just sort of living on a different planet, where engineers also are great, you know, businessmen as well? Well, I think you agree with me on that, and I, Tony duPont let us know for the record, was involved with the National Aerospace Plane, and was in the aerospace community, a respected engineer. And although a lot of people disagree with him on certain ideas, he is a maverick, and whenever we come to the point where we don't let mavericks and freethinkers have a chance to prove their theories, we are putting a great limitation on what our potential is for the future.

And I would say in retrospect, even after hearing all the things today, that the idea of a research project in order to determine the viability of a vectored thrust concept that might be utilized in short landing and takeoff, and also, might be utilized in a hovering type of capability, that that was a very good use of taxpayer dollars.

I sponsored an earmark for Tony for two years, when the bill went to NASA, and quite frankly, I would do it again, even after hearing all of this testimony. I did withdraw my support for earmarks for Tony, when he did not reach the deadline that I thought was an appropriate deadline.

You want to give an engineer an opportunity, you want to give free-thinkers and people who have great ideas an opportunity to do something, but you don't give them unlimited time and unlimited money, in terms of length of time. So, I withdrew at that time, saying Tony, you missed your deadline.

Let me ask this. I guess currently, you testified, to answer your question, that in 2003, the duPont operation did not meet the requirements that had been set down, but I have a report here that in 2004, correct me if I am wrong, that you found that "findings indicate that the contractor has brought forth considerable effort toward full implementation of standards" and the type of things that he wasn't doing the year before. Is that right?

Lieutenant Colonel TREMPER. Yes, sir. That is correct.

Mr. ROHRABACHER. Okay. So, they were lax at a certain time, and they took the moves and made the effort to correct those areas where they were lax. Is that——

Lieutenant Colonel TREMPER. Yes, sir.

Mr. ROHRABACHER. All right. And is it right for Congress to point out at one point, they were lax? Yes, it is. But it is just as important to point out that after calling it to their attention, they did make the moves to try to come into compliance.

VECTORED THRUST RESEARCH FUNDING

Do any of you believe that research into vectored thrust should not have had any exploratory and research money put into examining the concept of vectored thrust? Is that your testimony today?

Lieutenant Colonel TREMPER. I think that we would agree with that.

Mr. ROHRABACHER. So, you would agree that we should not have spent any money.

Lieutenant Colonel TREMPER. No, no, no.

Mr. ROHRABACHER. Okay.

Lieutenant Colonel TREMPER. That we should spend money.

Mr. ROHRABACHER. Okay. So, let the record note that the witnesses agree that the concept of vectored thrust did, as a concept, deserve to be looked at and researched, and let us also note that this is a research project, and in no way is it, should be held accountable to even the development phase, where they actually have working prototypes, and then they try to even correct the situation from there.

Is, let me say this—should this project, should the DP–2 now be permitted to fly in order to prove Tony's theories? Are we—would that not be a reasonable, would that be a reasonable request right now, that from us, as the taxpayers, that Tony duPont's ten year research project, $55 million, is a lot of time and effort, that he be permitted at this point to prove or disprove whether or not it will hover or take off in a short landing, short takeoff? Should we permit him to fly, or to try to fly that aircraft? We have got the project manager here. You guys are overseeing the project. Are we going to keep Tony, are we not going to give this man a chance to prove his ideas will or won't work?

Mr. KINZER. Sir, I will take a stab at that.

Mr. ROHRABACHER. Okay.

Mr. KINZER. We do have another six months on the current contract, during which time he has funding and has the time to demonstrate hover. The aircraft is on the test stand right now, and it has just passed a review, and it does have the potential, we think, to demonstrate extended hover within the current contract.

Mr. ROHRABACHER. And if he does prove that it hovers, that it simply hovers, this would be a major breakthrough, would it not?

Mr. KINZER. It would definitely give us a substantial amount of data with which to do further analysis.

Mr. ROHRABACHER. Right, and so, the data that we would receive, if this indeed hovers, would well be worth the $55 million investment into this direct research that the government has put forward. Is that right? Would you agree with that? If we actually succeed in hovering this craft, and are able to get the data from that, data or data, whatever it is, from that experiment, that this would be well be worth our while, would it not, especially if it leads to the development in the future of hovering aircraft based on that type of technology? Is that correct?

Mr. KINZER. Yes, sir.

CLOSING

Mr. ROHRABACHER. Yes. So, Mr. Chairman, I think that we should reconvene this hearing in San Diego, when Tony is ready to prove to us that he has something that will work, and I will be there, and I hope you will be, too, Mr. Chairman.

Thank you very much.

Chairman MILLER. Thank you for that generous offer, Mr. Rohrabacher. We do need to wrap up. We are out of time. Mr. Rohrabacher, you did refer and read from a document that you said was a 2004 evaluation, and no one on our staff knows what that is. Could you make that part of the record?

Mr. ROHRABACHER. Yes.

Chairman MILLER. You got it from us? Okay. If we could just see what it is, so we can make sure that we do have a copy of it.

Mr. ROHRABACHER. All right.

Chairman MILLER. Thank you, Mr. Rohrabacher, and thank you to all the witnesses. And I am in agreement with much of what Mr. Rohrabacher says. I think that we do need to be funding research. We need to be proceeding on many fronts in many areas. Certainly, research funding, research in military technologies, research in aeronautics and space technologies. And the easiest studies that the Federal Government funds to belittle are probably those of NIH, which are not within this committee's jurisdiction, many of which can be made to sound silly very easily, and there are a great many of them. And they are pure research. They are just research to find out, to satisfy some scientist's or some doctor's curiosity without any clear idea of what it will produce, or whether there will be any practical application, and there are hundreds of such projects, some of which have led to remarkable medical breakthroughs.

However, those are all decided by a panel of disinterested scientists, medical researchers, doctors in academic settings. We rely upon disinterested expert opinion, expert judgment, on what are the worthy avenues of research. What holds promise for us.

This hearing really is about accountability. We do expect those that we provide federal grants for research to be accountable for the money we provide them. And it is about accountability of Congress, too. We have to be held accountable for the decisions that we make.

I agree with Mr. Rohrabacher that an initial decision to see if this funding, if this concept could be made to work. It is one that I do not fault, even though it was, at the time, one that the experts viewed skeptically. But 20 years later, with every disinterested expert, not Mr. duPont himself, but those that we rely upon, DARPA, NASA, having concluded that this project is just fraught with problems, and enough problems that they simply will not yield to a solution, should we continue to fund this, or is there an accountability by Congress and of Congress and of Mr. duPont, that really would argue that Congress should not continue to impose our judgment, or to put forward our judgment against that of those with greater knowledge and greater expertise, on whose judgment we should rely.

Mr. Rohrabacher.

Mr. ROHRABACHER. Mr. Chairman, first of all, congratulations, and again, I have total agreement with you as Chairman of this subcommittee, for hearings like this, to get, to ask very specific questions of experts, to have a back and forth on issues like this.

I happen to have with me a model of the DP–2, and that I would like to present to the Chairman. And——

Chairman MILLER. And this is a value of less than $50.

Mr. ROHRABACHER. Yes, considerably less than $50, and this is supposedly what was going to be the commercial model of this craft. I think it was a dream worth pursuing, and a dream that still may come true. I think we need to let Tony prove or disprove his theory of vectored thrust, and if he does, and if it proves out to be correct, we some day may see this flying, and would have a dramatic impact on aviation in America. Or maybe it won't, because maybe the theory isn't accurate.

It was worthy of research to look into that idea, and here you go, Mr. Chairman, and maybe when it flies, we can, or if it does fly, we can all celebrate, and if it doesn't, we can say, at least I can say I think it was worthwhile looking into this project.

So thank you very much.

Chairman MILLER. Thank you, Mr. Rohrabacher, and we have completed our business. We are adjourned. Thank you again very much.

[Whereupon, at 12:28 p.m., the Subcommittee was adjourned.]

Appendix 1:

ANSWERS TO POST-HEARING QUESTIONS

ANSWERS TO POST-HEARING QUESTIONS

Responses by Anthony A. duPont, President, duPont Aerospace Company, Inc.

Questions submitted by Chairman Brad Miller

PRATT & WHITNEY TEST

Q1. In your testimony you discuss the 1996 Pratt & Whitney test of the duPont thrust vectoring system and claim: "As a result of the successful test, the remainder of the appropriated DP–2 funding was transferred to the Office of Naval Research, ONR, by DARPA, who wanted one of the services to continue the program."

During the 1996 Pratt & Whitney test, although the duPont Aerospace thrust vectoring system was able to turn the gas turbine engine the duPont structure disintegrated on the test stand due to problems with its structural integrity. Considering that, please explain why you describe this as a successful test?

A1. The Lockheed management and the DARPA program manager declared it a success. A principal reason for doing the test was to determine the losses in 90 degree hover thrust. The measured losses were five percent as opposed to the Navy estimate of 25 percent.

Q2. Were you aware—at the time (from 1988 when you received your first earmark for the DP–2 up until the mid-1990s) that DARPA was refusing to fund the DP–2 because of technical concerns they had with the DP–2 aircraft?

A2. No. The DARPA Director stated on several occasions that he did not know whether the DP–2 was a good idea or a bad idea, but he was determined to resist any earmark he could, and he needed the $3 million to cover other expenses. Later DARPA tried to justify this position by citing the Navy study and raising as many technical quibbles as they could, but it usually boiled down to the 25 percent thrust loss estimated by the Navy. Thus the priority on the full scale thrust vectoring system test when DARPA finally decided to spend some of the appropriated DP–2 funds.

Q3. What evidence do you have that after refusing to fund the DP–2 for several years, that DARPA actually wanted one of the military services to fund the DP–2 aircraft?

A3. DARPA wanted a military service to spend the remaining $12 million left in the $15 million DP–2 appropriation instead of managing the program themselves. They were not asking the service to fund it instead of using the appropriated funds.

INVESTING IN THE DP–2

Q4. In your testimony before, again, the Science Committee in 2001, you said that you had spoken with Boeing, Lockheed, and Grumman, and other aerospace companies about investing in the project, in the DP–2, and that none of them were willing to invest. Is that correct?

A4. No, it is not. I had talked to those companies about making parts of the airplane, when it was still an aluminum airplane design, and we weren't so much interested in them investing in the project as participating in it, and we would get outside investment and customer progress payments to pay for the construction of the airplane.

Q5. Did you ask them about investing in the concept, developing the concept of the DP–2 or the vectored thrust?

A5. No.

Q6. Below are excerpts of your testimony to the House Science Committee on May 9, 2001:

REP. DAVE WELDON: I just want to follow on, Mr. DuPont, with the, sort of the direction Mr. Lampson was going in. You laid out in your testimony some dollar figures on what it would cost to develop an airplane. I know there are some Boeing representatives sitting out there in the audience. Why doesn't industry just come along and fund you if this is really—because it sounds great. It sounds like a dream come true, actually. We've got all these concerns in this committee and in the Transportation Committee about our overcrowded airline infrastructure. And to have the capability to bring a system like this on board, *could solve a heck of a lot of problems. And to shorten the time duration to get from place to place certainly appeals to everybody, particularly U.S. Congressmen.*

But why doesn't industry just pile on and fund this? I mean, if I were the Chairman of Boeing or Airbus, I would be looking very closely at your little company and what you're doing. I mean, what's the problem here?

DUPONT: Well, I think the problem is the uncertainty whether it would work or not. I can remember an interview with the Vice President of American Airlines. He says, "Tommy [sic] [Tony], don't tell me why the airplane's good. I'll tell you why it's good." And he did. And then he says, "Now you tell me it's real." And I had a hard time answering that question. A lot better shape today because of the ONR project. But I think it was—and we've talked to Boeing, and we talked to Lockheed, and we talked to Grumman, and we talked to, in one way or another, almost everybody in industry years ago about doing exactly what you said—Why don't you invest in this great idea and get rich? And nobody was willing to do it. And I think it was primarily because of skepticism that you could actually accomplish it."

Please explain the contradiction in your testimony before the House Science Committee in 2001 in which you clearly testified that you spoke to Boeing, Lockheed, Grumman and other aerospace firms about "investing" in the DP–2 aircraft and your testimony to the House Science and Technology Committee on June 12, 2007 in which you, say you never asked these companies too invest in the DP–2 aircraft.

A6. In the 1970's the DP–2 was an aluminum airframe design, and the discussions with the airframe companies concerned building parts such as the wing, fuselage and tail on the basis that Boeing was then having Northrop build 747 fuselage components. We were asking them to complete the detail design, build the tooling and manufacture the part. This would require investment on their part which they could recover in the price of the parts. Nobody was willing to start making this investment up front without a production program in place. Some companies were, however, interested in participating once a viable number of orders had been booked.

Q7. Have you ever approached any commercial aerospace company seeking investment in, participation with, or any ether financial relationship regarding the research, development or testing of the DP–2?

A7. No.

Q8. Have any commercial aerospace companies ever offered to invest in the research, development or testing of the DP–2 aircraft?

A8. A few companies have expressed interest, but no definitive discussions have taken place.

Q9. If they have please, provide specific details about when this occurred, what they wanted to invest in and how much money they offered to or actually invested?

A9. In view of the answer to the previous question there are no details to provide.

1990 DARPA DP–2 TECHNICAL ASSESSMENT

Q10. In your testimony, you said "I don't know what credibility you want to put on this, but DARPA published a curve, in connection with that 1990 or some earlier review, that said that with the mixed exhaust that the DP–2 engine has, the airplane can hover over sod and asphalt."

10a.With what consequences?

A10. None.

Q10b. Is the attached graph the DARPA curve you were referring to?

A10b. Yes. The attached DARPA graph/curve from the agency's 1990 "Technology Assessment" of the DP–2 aircraft concept actually shows that the DP–2 would erode both sod and asphalt. The DARPA report itself was severely critical of the DP–2 concept and design and concluded, in fact, that the aircraft's attempt to land on sod, asphalt or other unprepared surfaces would create dust storms, impeding visibility, endangering ground personnel and possibly damaging the aircraft's engines. It also criticized duPont Aerospace for not providing any technical data on this critical issue in your proposal.

Q10c. Please explain how the DARPA report and the enclosed "curve" or graph squares with your testimony?

A10c. The DARPA report plotted an incorrect temperature. The engine then proposed for the DP–2 was the Pratt & Whitney JT8D–219 which incorporates an exhaust gas mixer and has a mixed exhaust temperature at maximum thrust of about 500 degrees Fahrenheit. The International Aero Engines V2500, which was selected during the DARPA contract in 1995, has a mixed exhaust temperature slightly less than 400 degrees Fahrenheit. Either of those temperatures puts the DP–2 below the limit for sod or asphalt.

Q11. What technical analysis has duPont Aerospace done to demonstrate the ground effects of the DP–2 in a hover mode over unprepared surfaces?

A11. CFD (Computerized Flow Dynamics) has been used to characterize the environment underneath the aircraft and during air drop.

ANSWERS TO POST-HEARING QUESTIONS

Responses by John F. Kinzer, Program Officer, Air Warfare and Weapons, Office of Naval Research

Questions submitted by Chairman Brad Miller

Q1. Do you believe that with the DP–2's mixed exhaust system that it would be capable of safely hovering over sod or asphalt?

A1. No. The proposed engines for the DP–2 are International Aero Engines (IAE) V2500, rated at 33,000 lbs thrust each. These engines are currently utilized in several Airbus and Boeing commercial airliners. At high power, these commercial aircraft have large hazard zones aft of the aircraft, which illustrate the high level of energy present in the exhaust, which is focused towards the ground for the DP–2. The exhaust environment produced at high power will be a jet velocity in excess of 650 ft/sec, at a mixed flow temperature of in excess of 300° F. The pressure produced by the aircraft is over twice the acceptable limit for sod operations, as defined by NASA TND–56. Damage to both the noted surfaces would be expected. Currently all DP–1 test operations are conducted over concrete or steel pads, for this reason.

Q2. Mr. Tony duPont has characterized the 1996 Pratt & Whitney test of the duPont thrust vectoring system as a "success." Do you agree with that characterization of the test?

A2. No. The test was partially successful, in that it demonstrated roughly 95 percent turning efficiency by the cascades through a 90 degree angle. However, the test was also a partial failure in that the cascade system failed catastrophically after only a limited amount of data was obtained.

Q3. Do you believe that all concerns regarding the DP–2's thrust vectoring system have been resolved as a result of development work on the DP–1 aircraft?

A3. No. On the contrary, no significant concerns have yet been resolved.

Q4. Do you believe it would be safe to permit the most recent version of the DP–2 aircraft (the DP–IC) to attempt to engage in conventional forward flight today?

A4. No. The risk would be extremely high. None of the aircraft systems or functional areas have been certified safe for flight, and several failures have occurred in tests to date that would have been catastrophic in conventional flight.

Q5. What is the Navy's estimate of the DP–2's Maximum Speed?

A5. There has been no independent estimate made of maximum speed.

Q6. What is the Navy's estimate of the DP–2's Cruise Speed?

A6. A conceptual design level estimate of cruise speed is approximately 275 knots at sea level standard day conditions—increasing to a maximum of 500 knots at 50,000 ft standard day conditions.

Q7. What is the Navy's estimate of the DP–2's Maximum Range with a Full Payload?

A7. With a 7,700 lb payload, and a vertical takeoff, a conceptual design level performance estimate indicates a maximum radius of approximately 180 nautical miles (nm), which would correspond to a range of approximately 360 nm. This range would be reduced if ambient temperatures exceed about 86° F. Above this temperature, the vertical takeoff performance begins to reduce.

Q8. What is the Navy's estimate of the DP–2's Payload capacity in tons?

A8. For a vertical takeoff, a conceptual design level analysis indicates a maximum fuel plus payload level of about 11,000 lbs, or 5.5 tons.

Questions submitted by Representative Dana Rohrabacher

Q1. Is the concept as envisioned by duPont Aerospace technically feasible? What are the most serious challenges? Could another company with more experience address those challenges more adequately?

A1. This program was initiated by Congress in FY 1988, funded by a series of congressional plus-ups and earmarks originating in the House Science and Technology Committee and the House Armed Services Committee, and involved multiple federal agencies including the National Aeronautics and Space Administration (NASA), the

Defense Advanced Projects Agency (DARPA), and the Navy. During that time, the Navy has meticulously followed the direction of both the House Armed Services and Science and Technology Committees in managing the DP–2 program.

Although the technology can probably be made to hover and fly conventionally, a significant redesign of the configuration is required to achieve this goal. When the required design changes are made, it is unlikely that the resulting performance capability could effectively compete with existing or planned systems and technologies for the commercial or military applications envisioned.

The most serious challenges are:

- Major—could require fundamental design change
  - — Propulsion system and integrated flight and propulsion control
    - Selection of appropriate materials/design to provide a robust cascade vanes and control box system capable of sustained operations in the propulsion system flowpath.
    - Demonstration of the cascade vanes and control box to provide adequate control power (in all axes) during both vertical mode flight and transition to and from wing borne flight.
    - Development of a flight control system with acceptable pilot workload to allow safe operations in a wide range of ambient conditions, day and night, in operational environments of interest, with the wide range of pilot skill levels typical for fleet pilots.
  - — Performance and handling qualities in the event of engine failure
    - Engine failure during Vertical Takeoff (VTO) or vertical landing operations could be catastrophic.
    - Directional control on engine failure will require a backup reaction control system, further depleting thrust on remaining engine and/or adding to empty weight.
  - — Suckdown
    - Location and configuration of lift jet (effectively single post) will likely result in significant suckdown/lift loss at liftoff, during short takeoff operations, and during inbound transitions to hover and outbound transitions to wing borne flight.
    - No anticipated benefits from induced favorable flow over lifting surfaces.
  - — Hot gas ingestion
    - The inlet configuration is inherently susceptible to engine stalls due to Hot Gas Ingestion. It is also prone to foreign object damage during operations in austere sites, as well as perhaps ground vortex generation. This will likely require a relocation of the inlets, or potentially the use of auxiliary inlet doors. This would add weight and complexity.
- Significant—could seriously compromise operational utility
  - — Jet blast effects
    - Will preclude operations from unprepared surfaces.
    - Limits utility in operations that require personnel/equipment exposure below aircraft.
  - — Radar signature
    - Configuration not suitable for low frequency signature reduction.
    - Large inlets, exhaust configuration likely to limit signature reduction potential.
    - Thermal signature highest in most exposed area.
  - — Limited range/payload
    - Navy conceptual design levels estimate of less than 200 nmi radius, not including redesign driven by major issues.
  - — Composite Structure
    - Composites in hot section not likely to meet durability requirements.

  - Overall composite fabrication approach (including honeycomb use) not likely to meet Naval marine environment durability requirements.
  - Replacing honeycomb core composites with a suitable composite approach, or metal as appropriate, will increase weight and reduce performance.

— Control instability/cross coupling

  - Pitch and roll control have "non-minimum phase zero" reversal effects that will require a highly augmented flight control system for piloted control, and limit ability to precisely control hover.
  - Pitch and yaw control are coupled; Pitch/Roll/Yaw control all couple with thrust control.

— Center of gravity limits

  - The control system needs to accommodate the typically wide range of center of gravity locations typical for transport type aircraft.

— Directional control

  - Yaw control power appears inadequate in current configuration to control inlet induced (ram drag) instability with any appreciable crosswind/sideslip.

— Noise

  - High velocity exhaust flow will be noisy.

Due to a lack of experience, duPont Aerospace can only accomplish a small portion of the required development and testing. A project of this complexity requires significantly more engineering and management expertise than is currently possessed by duPont Aerospace.

Q2. What would it take to make the DP–2 program succeed? How much more money would it cost to complete? How long of a schedule? What type of program management is needed? What type of oversight is needed?

A2. The concept as envisioned by duPont Aerospace cannot succeed, because resolution of the technical issues will compromise performance to the point where it will not be able to effectively compete for any mission with existing or planned systems and technologies. It is possible that the thrust vectoring system technology could be reconfigured for other applications, for instance a sea based unmanned aerial vehicle. The program plan for this would have to be developed and would require significant management changes.

It is difficult to answer questions on estimated program cost and schedule, given the remaining technical issues to address. If further resources are committed examining the DP–2 concept, a fundamental redirection towards small-scale testing is suggested—which is likely outside the experience base and technical capabilities of duPont Aerospace. The current technical path of the DP–1 demonstrator is expensive, unproductive, and unlikely to result in successful maturation of the concept.

Q3. If the DP–2 program was to overcome the serious technical issues it now faces, does the concept have a viable application? Who could that application serve? What level of improvement would the DP–2 have over existing capabilities?

A3. Possibly yes. The DP–2 concept itself, as described above, is not viable, and is not competitive with existing capabilities. However, the thrust vectoring technology it contains is potentially applicable to unmanned aerial vehicle missions involving sea-based surveillance, sea-based support of distributed operations, and V–22 escort. This thrust vectoring technology is one method of achieving high speed VTOL flight, but others methods do exist, and all would need to be considered during exploration of concepts to meet these mission needs. The applications described above could serve the Navy and/or Marine Corps.